

# **Flood Hazard Mitigation**

## **A Plan for South Carolina**

Prepared for:



Department of Natural Resources  
Land, Water and Conservation Division  
Flood Mitigation Office

Prepared by:

The Flood Hazard Mitigation Advisory Committee

With Support From  
The Hazard Mitigation Technical Assistance Partnership, Inc.  
Park Forest, Illinois

*Flood Hazard Mitigation*  
*A Plan for South Carolina Agencies*  
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## *Acknowledgments*

*Flood Hazard Mitigation: A Plan for South Carolina* was drafted by the South Carolina Flood Hazard Mitigation Advisory Committee. The Committee included representatives of the following agencies and organizations:

### State Agencies

- Governor's Office, Budget and Control Board - State Building and Property Services, State Engineer's Office and Office of Insurance Services
- Office of the Adjutant General - Emergency Preparedness Division
- Department of Commerce - Division of Community Grant Programs
- Department of Education - District Facilities Management
- Department of Health & Environmental Control - Offices of Environmental Quality, Health Facilities Construction, Mining and Solid Waste Permitting, Dam Safety, Construction and Stormwater Management, Ocean and Coastal Resources Management
- Department of Insurance
- Department of Labor Licensing & Regulations - Office of State Fire Marshall
- Department of Natural Resources - Land, Water and Conservation Division
- Department of Transportation
- South Carolina Sea Grant Consortium
- University of South Carolina, Hazards Research Lab

### Federal Agencies

- Department of Commerce - National Oceanic and Atmospheric Administration, National Weather Service
- Federal Emergency Management Agency - Region IV Mitigation Division
- Army Corps of Engineers - Charleston District Flood Plain Management Services
- Department of Agriculture - Natural Resources Conservation Service
- Department of the Interior - U.S. Geological Survey

### Associations

- South Carolina Association for Hazard Mitigation
- American Planning Association (SCAPA)
- South Carolina Association of Counties

Technical Support was provided by the Hazard Mitigation Technical Assistance Partnership, Inc., Park Forest, Illinois

# *Flood Hazard Mitigation: A Plan for South Carolina*

## *Executive Summary*

### **1. Introduction**

South Carolina's 4,000 square miles of floodplain have more than 150,000 households subject to flooding. Parts of the State have experienced some of the nation's worst flooding in recent years and parts have not been hit for many years. While the hazard and recent experience varies, floodplain managers agree that it's not *if* an area will flood, but *when*.

The sum total of flood damage on state agencies and the economy, even with Federal disaster assistance, reaches into the millions. One way to reduce this cost is through flood hazard mitigation.

To identify the most appropriate flood hazard mitigation measures for South Carolina, a Flood Hazard Mitigation Advisory Committee was created. The Committee included State, Federal and private agencies and organizations that implement mitigation programs or are stakeholders in floodplain development.

With staff support from the Department of Natural Resources' Flood Mitigation Office, the Committee drafted *Flood Hazard Mitigation: A Plan for South Carolina*. Copies of the full draft plan can be downloaded from the DNR web site at [www.dnr.state.sc.us](http://www.dnr.state.sc.us). Comments on the draft plan are encouraged and should be submitted to:

South Carolina Department of Natural Resources  
Flood Mitigation Office  
2221 Devine Street, Suite 222  
Columbia, SC 29205  
803/734-9120  
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[holland@water.dnr.state.sc.us](mailto:holland@water.dnr.state.sc.us)

## 2. The Problem: The State's Flood Hazards

Flooding is a natural occurrence. Flood problems are brought on by human development, affecting both the immediate floodplain and properties downstream and along the shore. In recent decades, development along waterways and shorelines has been spurred by the aesthetic and recreational value of these sites. The result has been an increasing exposure to damage and destruction wrought by the natural forces of flooding on human development.



The winds and floodwaters of Hurricane Hugo caused the greatest natural disaster in South Carolina history.

**Types of floods.** There are five distinctive types of flooding in South Carolina:

- 1) Flash flooding. This is the primary hazard in the hilly terrain of the northwest and in cities with large areas of impervious surfaces.
- 2) Riverine flooding. These floods occur in the Piedmont and Coastal Plain areas which are subject to overbank flooding of rivers and streams.
- 3) Coastal storms and hurricanes: Coastal shorelines are subject to the very destructive flooding, storm surge, wave action and erosion caused by storms and hurricanes. The concentration of people and development in the large exposed low country floodplains makes this the State's worst flood hazard.
- 4) Local drainage problems: These can occur anywhere in the State where the ground is flat, where the drainage pattern has been disrupted, or where channels or culverts have not been maintained.
- 5) Dam failure: These also can occur anywhere in the State where there is a dam.

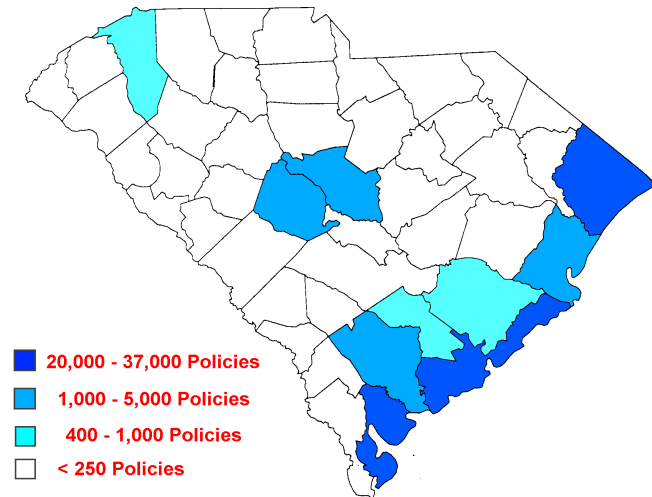


Floods can wash out roads and damage or destroy other infrastructure.

## Flood Exposure

The only readily available statistics on the State's exposure to flooding are based on the number of flood insurance policies. While not a basis for an accurate count of floodprone buildings, the number of flood insurance policies does represent where the hazards are and where the most properties are exposed. There are over 105,000 policies in South Carolina (the State ranks sixth in the nation).

The greatest concentration of policies is on the coast. The overwhelming majority of all policies (95.6%) are in the eight coastal counties. Nearly 90% of all policies (and therefore nearly 90% of the exposure) is in three counties: the coastal population centers of Charleston, Myrtle Beach and Hilton Head Island. The coastal counties also account for 99% of the State's repetitive flood insurance losses.



Counties with the most flood insurance policies  
Source: National Flood Insurance Program

Inland, the counties with the largest number of policies are Lexington and Richland, around Columbia, the largest population center in the State, followed by Greenville County.

### 3. State Mitigation Goal and Objectives

The Flood Hazard Mitigation Advisory Committee set one overall goal for its efforts:

*Protect the people and property of South Carolina from the dangers and damage caused by flooding.*

The Committee defined its vision for the future by calling for reserving undeveloped floodplains as natural areas or for low intensity development. Areas already urbanized would be protected from flood damage in accordance with comprehensive local mitigation plans.

The Committee identified seven objectives to reach this goal and vision. These form the basis for the seven general themes of the Action Plan found in Chapter 6.

#### 4. Possible Solutions: Mitigation Strategies and Measures

There are a variety of approaches to flood hazard mitigation. They are organized under six general strategies:

- 1) **Prevention** measures, such as planing, zoning, and building codes, which are designed to keep the problem from occurring or getting worse. They ensure that future development does not increase flood damage.

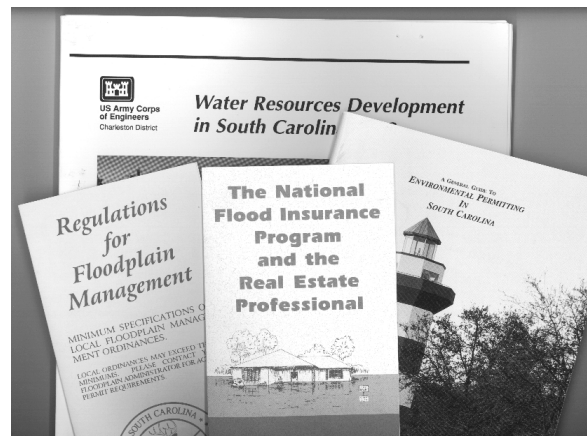
- 2) **Property protection** measures which modify buildings or other facilities to protect them from flood damage. They include acquisition, building elevation (see photo), floodproofing, and insurance.



The house on the right was elevated well above the 100-year flood level after it had been flooded several times.

- 3) **Natural resource protection** activities preserve or restore natural areas or the natural functions of floodplains, shorelines, wetlands and watersheds. They produce flood loss reduction benefits as well as improve water quality and habitats.
- 4) **Emergency service** measures protect people during and after a flood. They include early warning, response, and recovery during and after a flood.
- 5) **Structural projects** are used to prevent floodwaters from reaching properties. These measures involve construction of facilities to control water flows, such as dams, levees, channels and dunes.

- 6) **Public information** activities advise property owners, potential property owners and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of floodplains.



## 5. Who Can Help: Agencies and Programs

Chapter 5 reviews those State and Federal agencies and private organizations that can have a role in flood hazard mitigation. Most of them were represented on the South Carolina Flood Hazard Mitigation Advisory Committee (see inside front cover). At the end of Chapter 5 is a matrix that matches these agencies with the mitigation strategies (from Chapter 4) that they are involved with.

## 6. Action Plan

The *Plan* has 44 recommendations to implement a variety of activities by State and Federal agencies. The recommendations are in the form of action items, listed in order of seven general objectives that were identified as part of the goal setting. Each action item has lead and supporting agencies identified. All lead agencies are state agencies.

### *6.1. Coordinate State and Federal flood mitigation programs so they will operate more effectively and efficiently*

#### 6.1.1. Establish a Flood Mitigation Coordinating Committee whose primary duties would be to:

- Act as a forum to communicate the status of Federal, State and local flood hazard mitigation programs.
- Review conflicts between Federal, State and local plans and programs and recommend solutions.
- Monitor implementation of this plan's recommendations, evaluate progress and make appropriate revisions.

#### 6.1.2. Encourage other organizations to participate in Committee activities

#### 6.1.3. Clarify and simplify the flood mitigation responsibilities currently undertaken by various state agencies

#### 6.1.4. Establish a post-disaster mitigation coordinating mechanism

#### 6.1.5. Identify research needs and coordinate research activities to support mitigation programs

### *6.2. Provide flood data and maps to support mitigation programs*

#### 6.2.1. Establish a river gage priority system to identify where additional gages are most needed

#### 6.2.2. Establish a mapping priority system

#### 6.2.3. Improve the process for revising regulatory maps

#### 6.2.4. Complete the National Wetlands Inventory

#### 6.2.5. Survey in permanent elevation reference marks

### *6.3. Regulate future development to prevent increasing flood hazards and losses*

- 6.3.1. Develop a master set of appropriate floodplain construction standards
- 6.3.2. Ensure that Federal programs comply with Executive Orders
- 6.3.3. Update the State's 1982 Executive Order on floodplain management
- 6.3.4. Adopt and enforce more encompassing erosion and sediment control and stormwater management standards

*6.4. Protect existing development from flood damage*

- 6.4.1. Prepare a profile of the State's flood hazard exposure by assembling a database that includes critical facilities and State-owned properties
- 6.4.2. Ensure that plans for structural flood control projects consider nonstructural alternatives
- 6.4.3. Ensure that beach protection projects prohibit seawalls and groins and that communities adopt dune and beach maintenance plans

*6.5. Provide warning and emergency response activities to protect lives and property during a flood*

- 6.5.1. Expand the gaging and automatic warning systems
- 6.5.2. Use GIS to show what areas will be flooded when forecasts are issued
- 6.5.3. Publicize how stream gage data relates to areas to be affected
- 6.5.4. Locate staff gages on all highway underpasses subject to flooding
- 6.5.5. Develop and implement site-specific gage data and flood warning and response plans
- 6.5.6. Provide model documents on flood warnings, flood safety and evacuation procedures
- 6.5.7. Help owners and managers of floodprone facilities develop their own site-specific flood response plans

*6.6. Support and improve local mitigation programs*

- 6.6.1. Identify Federal, State and private post-disaster funding programs
- 6.6.2. Local comprehensive plans and ordinances should show known flood problem areas and identify land uses appropriate for the hazard
- 6.6.3. Develop and implement pre-disaster mitigation plans that identify mitigation sites and that establish post-disaster mitigation procedures
- 6.6.4. Assist and encourage communities to adopt and enforce more restrictive construction standards appropriate for local flooding conditions
- 6.6.5. Help local permit officials with new training opportunities and a floodplain manager certification program
- 6.6.6. Inform communities on open space programs

- 6.6.7. Improve local drainage system maintenance
- 6.6.8. Encourage communities to join the Community Rating System

*6.7. Provide flood protection information to property owners*

- 6.7.1. Implement locally appropriate public information programs
- 6.7.2. Provide information and technical assistance to property owners
- 6.7.3. Work with local schools to incorporate flood issues in curriculums
- 6.7.4. Better inform potential purchasers of floodprone property
- 6.7.5. Increase insurance agents' knowledge and interest in flood insurance
- 6.7.6. Work with organizations of farmers, businesses and consultants to increase their knowledge and interest in hazard mitigation

In sum, the extent of the State of South Carolina's exposure to flooding and the breadth of possible actions that can be brought to bear call for a substantial flood mitigation program. However, there are many State and Federal and private organizations that can play a role in reducing flood losses.

The thrust of the Action Plan is to have a coordinated, cooperative and efficient state-wide program to mitigate flood losses. The 44 action items are realistic and will be effective. Many work to increase awareness and knowledge of flood hazards and flood protection so communities and property owners can help themselves. They are spread among several State and Federal agencies and build on existing programs, so they can be conducted at little or no additional cost to the agencies.

This *Plan* and its action items are recommended for implementation. Once begun, they should be monitored and evaluated by the Flood Mitigation Coordinating Committee. Revisions to this *Plan* should be made as needed.

## *Agency Concurrence*

The following agencies have reviewed this *Flood Hazard Mitigation Plan for South Carolina Agencies* and concur with its recommendations. They agree to participate on the Flood Mitigation Coordinating Committee and assist in implementing their share of the Action Plan.

- ! Governor's Office, Budget and Control Board
- ! Office of the Adjutant General
- ! Department of Archives and History
- ! Department of Commerce
- ! Department of Education
- ! Department of Health & Environmental Control
- ! Department of Insurance
- ! Department of Labor Licensing & Regulations
- ! Department of Natural Resources
- ! State Ports Authority
- ! Department of Transportation
- ! South Carolina Sea Grant Consortium
- ! University of South Carolina, Hazards Research Lab
- ! U.S. Army Corps of Engineers
- ! U.S. Department of Agriculture, Natural Resources Conservation Service
- ! U.S. Department of the Interior
- ! Federal Emergency Management Agency
- ! National Oceanic and Atmospheric Administration
- ! South Carolina Chapter, American Planning Association
- ! Municipal Association of South Carolina
- ! South Carolina Community Development Association
- ! Southern Region, National Trust for Historic Preservation
- ! South Carolina Association of Counties
- ! South Carolina Association for Hazard Mitigation
- ! South Carolina Environmental Education Association



## 1. Introduction

South Carolina's 4,000 square miles of floodplain have more than 150,000 households subject to flooding. Parts of the State have experienced some of the nation's worst flooding in recent years and parts have not been hit for many years. While the hazard and recent experience varies, floodplain managers agree that it's not *if* an area will flood, but *when*.

The consequences of flooding can be traumatic. They impact individuals, communities and the entire State. People get killed, homes are lost, valuables can never be replaced. Marginal businesses close down and repeated flooding turns nice neighborhoods into abandoned slums.



**Figure 1-1** *The winds and floodwaters of Hurricane Hugo caused the greatest natural disaster in South Carolina history.*

The sum total of flood damage on state agencies and the economy, even with Federal disaster assistance, reaches into the millions.

One way to reduce this cost is through flood hazard mitigation.

*"Hazard mitigation:" The Federal Emergency Management Agency's (FEMA) National Mitigation Strategy defines hazard mitigation as "sustained action taken to reduce or eliminate long-term risk to people and property." Flood hazard mitigation includes those actions taken to protect people and property from flooding.*

### 1.1. The Charge

Many Federal, State, local and private agencies and organizations can affect hazard mitigation. However, without a coordinated effort, some activities may run at cross purposes, some may duplicate others, and some key activities may be neglected. Accordingly, the Department of Natural Resources tasked its Flood Mitigation Office to develop a state-level effort to improve flood hazard mitigation in South Carolina.

In response, the Flood Mitigation Office established the Flood Hazard Mitigation Advisory Committee. The Committee was charged with developing a plan of recommended activities for State and Federal agencies and to monitor and coordinate efforts pursuant to that plan. This document is that plan.

## *1.2. The Process*

In order to identify what's needed and who should do it, the Committee used a planning process that follows the order of the chapters in this plan. The following subjects were reviewed:

- The State's flood hazards and their impact on development (Chapter 2)
- Goals and objectives for a State mitigation program (Chapter 3)
- The full range of things that could be done about these hazards (Chapter 4)
- What State agencies are currently doing in hazard mitigation (Chapter 5)

At the end of Chapter 5, the State agency activities are summarized in a matrix that matches the agencies with the types of mitigation programs that they are involved in.

To implement the goals and objectives, the Committee identified recommendations for activities that can be implemented by State and Federal agencies. The recommendations are consolidated into an Action Plan that identifies who should do what by when (Chapter 6).

The thrust of the Action Plan is to have a coordinated, cooperative and efficient state-wide program to mitigate flood losses. Most of the actions are inexpensive and build on existing programs. Many work to increase awareness and knowledge of flood hazards and flood protection so communities and property owners can help themselves.

A previous mitigation planning effort was conducted following Hurricane Hugo and published in an Interagency Hazard Mitigation Team Report (for FEMA 843-DR-SC, October, 1989). Some of that report's recommendations have been accomplished, but most have not. Preparation of this flood hazard mitigation plan included a review of the Hugo report and addresses many of the recommendations that have not yet been completed.

## *2. The Problem: The State's Flood Hazards*

The first thing to remember in flood hazard mitigation is that flooding is a natural occurrence. Throughout time, floods have altered the floodplain landscape. These areas are continuously shaped by the forces of water — either eroded or built up through deposit of sediment.

More recently, the landscape has been altered by human development, affecting both the immediate floodplain and properties downstream and along the shore. During the early settlement of the State, locations near water provided necessary access to transportation, water supply and water power. In addition, these areas had fertile soils, making them prime agricultural lands.

In recent decades, development along waterways and shorelines has been spurred by the aesthetic and recreational value of these sites. The result has been an increasing exposure to damage and destruction wrought by the natural forces of flooding on human development.

### *2.1. Flood Damage*

Flooding causes problems to people and development. Floods affect everyone, even those not directly damaged, because of their ripple effect on the community and the economy.

**Impact on people.** Floods can kill people. They rob survivors of their property, possessions and time. They pose health hazards from polluted water, mildew, and fatigue. They also generate stress on people, and cause mental health strains from property damage and the loss of irreplaceable family treasures.

Property damage can be measured in dollars; the losses to people of time, energy and emotional well-being cannot. In addition, these intangible losses are not covered by any insurance or disaster assistance programs.

**Economic impact.** Floods can cause severe damage to the economy. Buildings and inventories are simply lost to water. Income is lost as businesses are forced to close by floodwaters, or lose customers who cannot get to the establishments.



*Figure 2-1 Standing water can devastate a home and cause thousands of dollars in property damage.*

The loss of income can have a ripple effect on jobs and other related businesses. Floods are renowned for adding one problem too many to struggling businesses and forcing them to close or relocate out of the area.

**Infrastructure damage.** Flooding of streets, highways and underpasses affects many more people than just those who live in floodplains. Travelers, commuters and commerce are affected. Most flood deaths are a result of driving or riding into floodwaters, the threat to life is not limited to floodplain residents.



**Figure 2-2** *Floods can wash out roads and damage or destroy other infrastructure.*

Even areas not under water are impacted by a flood. When flooding enters a water or wastewater treatment plant, the entire community may lose its water supply and have its sanitary sewers overloaded. Overloaded sewers can flood streets and homes with sewage. Downstream communities may be flooded by polluted water.

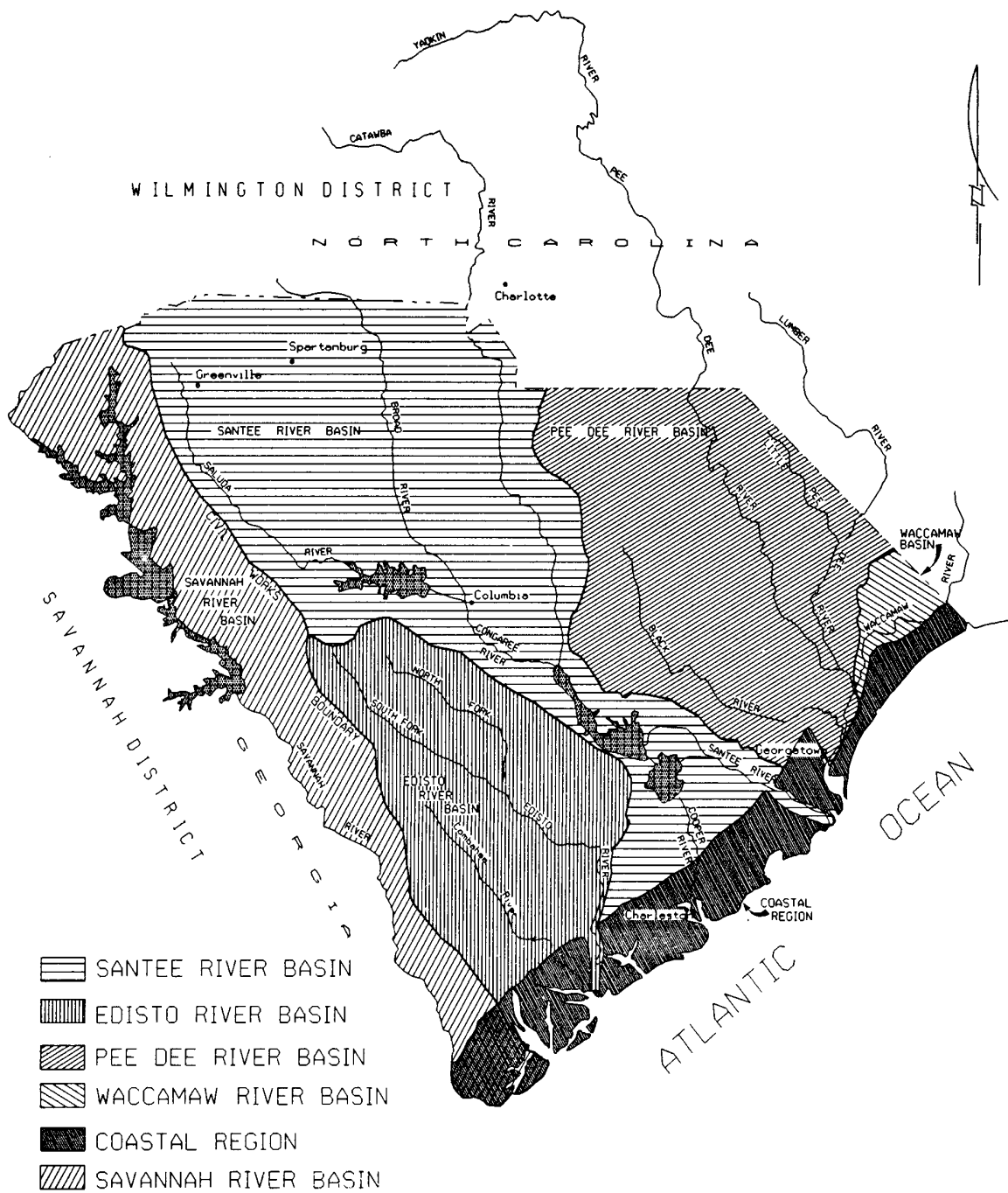
When the streets are flooded or water, sewer or other utility services are down, businesses cannot operate. Employees, customers and needed deliveries can't get to them and shipments can't get out. If down too long, marginal businesses may close for good.

## **2.2. Types of Floods**

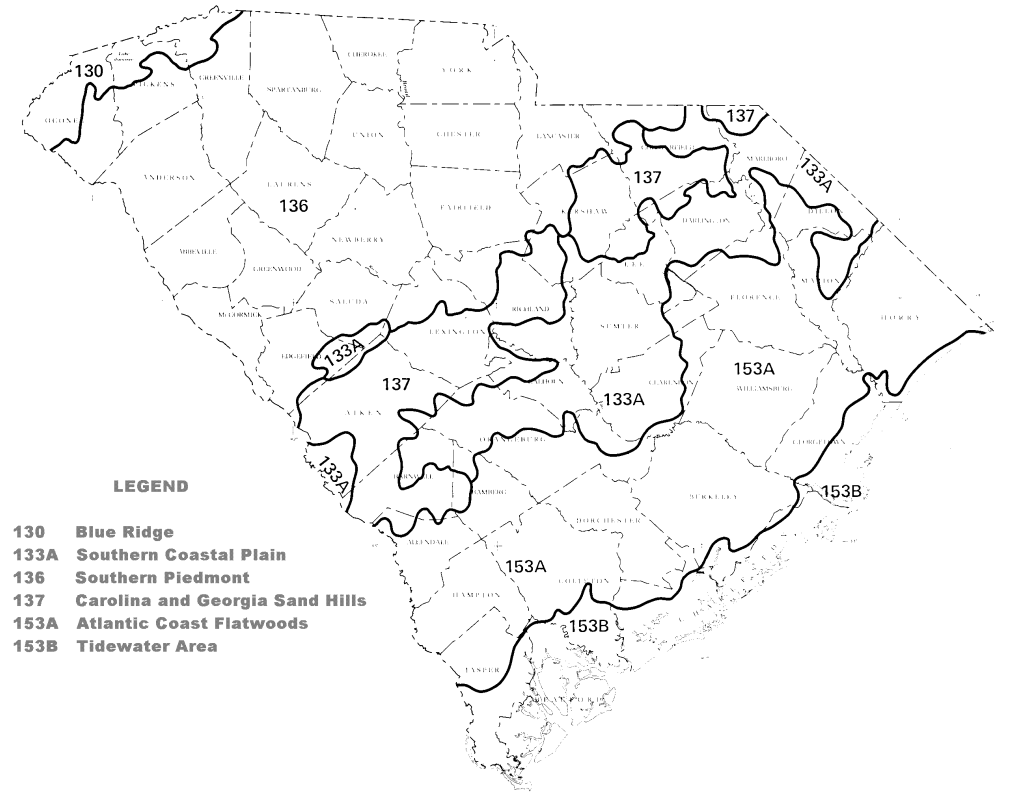
South Carolina has five major river basins and one coastal region. These are shown in Figure 2-3. The State's rivers generally start in the northwest and flow southeasterly to the Atlantic Ocean. They pass through three physiographic areas:

- The Blue Ridge Mountains, where the big rivers begin. This hill country is in the northwestern corner of the State.
- The Piedmont Plateau, and
- The Coastal Plain.

The U.S. Department of Agriculture, Natural Resources Conservation Service, identifies six major land resource areas that follow a similar pattern - Blue Ridge Mountains in the northwest that drain to the Piedmont and sand hills and then to the Coastal Plain, Flatwoods and Tidewater Areas (Figure 2-4).



**Figure 2-3** River basins. Source: Water Resources in South Carolina, U.S. Army Corps of Engineers, 1993



*Figure 2-4 Major land resource areas.*  
*Source: Natural Resources Conservation Service, 1981*

There are five distinctive types of flooding in South Carolina. The first three are related to the three physiographic areas:

- Flash flooding: Flash floods move fast and offer little warning time. They are the primary hazard in the hilly terrain of the northwest and in cities with large areas of impervious surfaces. Flash floods can occur anywhere, especially during and after heavy thunderstorms that stall or move repeatedly over the same area.
- Riverine flooding: The Piedmont and Coastal Plain areas are subject to the slower moving overbank flooding of the State's many rivers and streams. These floods usually rise and fall slowly, giving adequate warning time.
- Coastal storms and hurricanes: Coastal shorelines are subject to the very destructive flooding, storm surge, wave action and erosion caused by storms and hurricanes. While there may be plenty of warning time, the

concentration of people and development in the large exposed low country floodplains makes this the State's worst flood hazard.

- Local drainage problems: These can occur anywhere in the State where the ground is flat, where the drainage pattern has been disrupted, or where channels or culverts have not been maintained.
- Dam failure: These can also occur anywhere in the State where there is a dam that could suddenly release its impounded water due to overtopping or failure.

### ***2.3. Flash Flooding***

Flash floods are caused by locally heavy rains in areas where the water runs off quickly. The quick runoff may be due to steep terrain, impervious surfaces or saturated ground. These conditions exist in hilly areas, urbanized areas or after a prolonged period of rain.

Flash floods are the killer floods. They catch people unaware, often in their vehicles when bridges are washed out (70% of flash flood deaths occur when vehicles are driven into the water). Recent flash flooding reports note the damage to cars in parking lots when the owners didn't have time to move them to safety.

South Carolina's largest flood in terms of loss of human life and property damage occurred along the Pacolet River on June 6, 1903. This flood occurred when a low pressure system stalled over the mountains and upper Piedmont of the State. Accounts at Pacolet Mills in Spartanburg County reported that the river rose 41 feet in 40 minutes.

Damage was estimated at \$3,866,000. The figure includes destruction or significant damage to 7 cotton mills, 13 railroad bridges, 17 farm houses and crop losses. Sixty-two people were killed and 4,300 workers were out of work. The flooding was compounded by a dam failure at Pacolet. Some more recent flash floods are shown in Table 2-1.

<i>Counties</i>	<i>Date</i>	<i>Deaths</i>	<i>Damage</i>
<i>Laurens</i>	<i>September 1973</i>	<i>0</i>	<i>\$6 million</i>
<i>Newberry, York, Chester</i>	<i>August 1986</i>	<i>3</i>	<i>\$1 million</i>
<i>Pickens</i>	<i>March 1990</i>	<i>0</i>	<i>\$9 million</i>

<i>Counties</i>	<i>Date</i>	<i>Deaths</i>	<i>Damage</i>
<i>Greenville</i>	<i>August 1995</i>	<i>2</i>	<i>\$3 million</i>
<i>Pickens</i>	<i>February 1998</i>	<i>1</i>	<i>--</i>

**Table 2-1** *Recent Flash Floods*

*Source: FEMA and U.S. Army Corps of Engineers post-flood reports*

## **2.4. Riverine Flooding**

There is more warning time for riverine flooding on the larger rivers in the Piedmont and Coastal Plain. However, there is often more development in the path of these floods. While there may be less loss of life, the property damage can be extensive. The danger and damage is compounded by dam failures which have occurred with many of the recent floods.

The worst riverine flooding in recent times came October 10 - 29, 1990 during Tropical Depression Klaus and Tropical Storm Marco. Eleven of the State's fifteen major river basins exceeded flood stage.

Within a 24 hour period, some areas in the counties of Orangeburg, Sumter, Kershaw, Lancaster, and Chesterfield had experienced as much as 10-15 inches of rain exceeding the 50-100 year expected rainfall amounts. Streams in Lee and Darlington Counties had flood crests well above the 100-year flood levels.

- There were seventeen reported dam failures and an additional thirty-one dams were overtopped
- More than 120 bridges were closed or washed away
- Secondary roads were washed out in all impacted counties
- A railroad track was flooded in Calhoun County causing a train to derail
- Five people were killed
- Damage was estimated at over \$3 million

## **2.5. Coastal Storms**

Coastal storms include hurricanes and "nor'easters." The latter are winter storms whose winds come from the northeast. There is more of an historical record on hurricanes because of their greater impact.

The first recorded hurricane to hit South Carolina was in late summer of 1686. It destroyed crops, trees, boats, and buildings. Since then, the State has been hit by more than 45 hurricanes or major coastal storms.

Litchfield Beach in Georgetown County was hit hard by a storm in 1893. One house survived because it stood on high ground; the rest were destroyed, and most of the residents drowned. Survivors estimated wave heights at 40 feet.

The six most severe storms of the twentieth century are summarized in Table 2-2. Note that there is a general trend toward fewer deaths as hurricane warning and evacuation procedures have improved over the years.

<i>Date</i>	<i>Name</i>	<i>Category</i>	<i>Deaths</i>	<i>Damage</i>
1911			17	\$1 million
1928			5	\$2+ million
1940			34	\$10 million
1954	Hazel	4	1	\$27 million
1959	Gracie	3	0	\$3 million
1979	David	2	0	\$10 million
1989	Hugo	4	35	\$7 billion

**Table 2-2** Major 20th Century Hurricanes

Source: *Living with the South Carolina Coast*, Lennon, et. al., 1996, Flood Hazard Mitigation Advisory Committee members

Flooding from Hurricane Hugo dwarfs all other floods in South Carolina's history. The statistics are staggering: 264,000 people evacuated, \$2 billion in agricultural damage, the second largest claim event in the history of the National Flood Insurance Program, etc. Luckily its worst fury was spent on a relatively undeveloped area north of Charleston.

Hugo can be repeated next year. Figure 2-6 shows the tracks of hurricanes over the last 115 years. This map also shows that hurricane flooding (either coastal storm surge

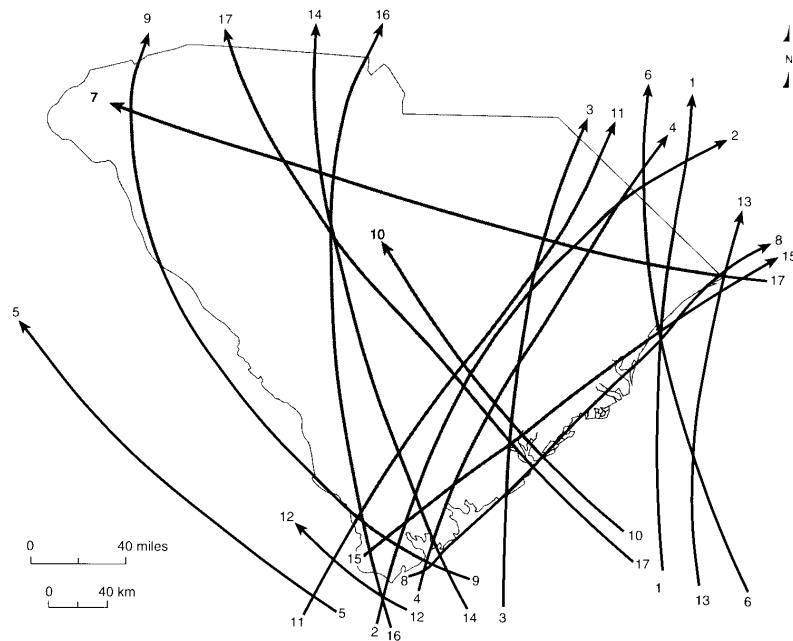


**Figure 2-5** Hurricane Hugo showed that only properly constructed buildings can withstand winds and floods.

or flash and riverine flooding from the heavy rains) can affect every part of the State.

## 2.6. Local Drainage Problems

Local drainage problems can occur anywhere in the State. These happen where the ground is flat or where human development has disrupted the natural drainage pattern. Heavy local storms will cause water to pond or back up in a blocked channel, where the channel capacity has been exceeded due to increased runoff from development, or where a storm sewer or culvert is too small to accept all the runoff.



(1) 1883, MH	(6) 1899, MH	(10) 1916	(14) 1959 (Gracie),
(2) 1885, EH	(7) 1906, GH	(11) 1928, GH	MH
(3) 1893, MH	(8) 1910, GH	(12) 1940, MH	(15) 1966 (Alma),
(4) 1894	(9) 1911, MH	(13) 1954 (Hazel),	MH
(5) 1898, EH		GH	(16) 1979 (David)
			(17) 1989 (Hugo),
			GH

*EH, extreme hurricane; GH, great hurricane; MH, major hurricane.*  
[These are terms used in the reference and do not necessarily relate to the Saffir/Simpson Hurricane Scale.]

**Figure 2-6** Hurricane tracks across South Carolina, 1883-1989.  
Source: *Living with the South Carolina Coast*, Lennon, et. al., 1996

Local drainage problems usually produce only shallow flooding in streets and yards. However this water can get into low lying houses and cause damage to buildings with floors below grade. Clay soils obstruct percolation, resulting in standing water that covers septic systems and causes a health problem.

There are few statistics on this type of flooding, as usually it will not result in a disaster declaration or a flood insurance claim. One measure of the problem is the amount of money communities are willing to spend to correct local drainage problems. The City of Hilton Head Island found its only evacuation route cut off by such flooding in October 1994. It has since embarked on a multi-million dollar effort to improve local drainage.

## **2.7. Dam Failure**

Dam failures cause another type of flash flood. The sudden release of the impounded water can occur during a flood that overtops or damages a dam or it can occur on a clear day if the dam has not been properly constructed or maintained. It is estimated that there are two or three dam failures each year. Many of them are small and have no impact on human development.

Dam failures can occur anywhere there is a dam. As shown in Figure 2-7, only some parts of the coastal plain are free of dams because the flat terrain does not make reservoirs cost effective.

The threat from dam failures increases as existing dams get older and more are being built for retention basins and amenity ponds in new developments. Many are on smaller streams that are not mapped as floodplains or subject to floodplain regulations. Even when the stream is mapped, the floodplain is usually not based on a dam breach inundation map, leaving downstream residents unaware of the potential dangers.

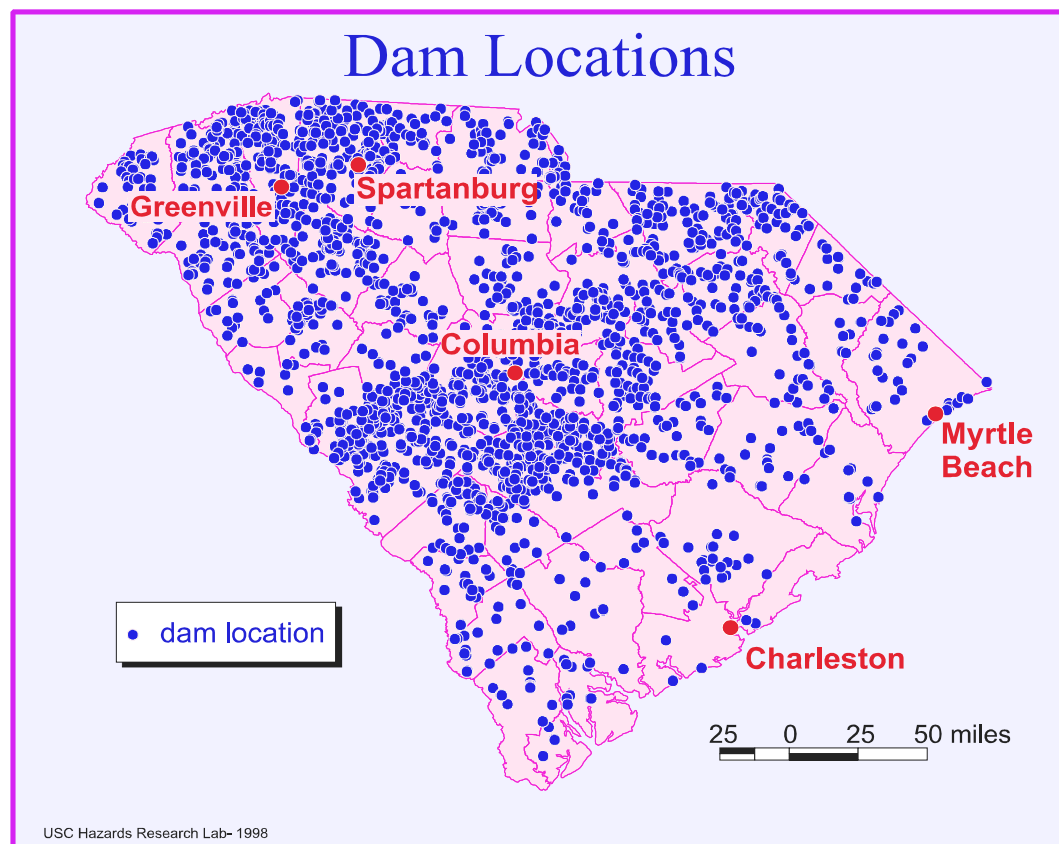
*Figure 2-7 Dam locations*  
*Source: USC Hazards Research Lab*

## **2.8. Flood Exposure**

A mitigation plan needs to prepare for the next flood, not the last one. As history has shown, the next one can come at any time of the year and hit any part of the State. If it hits a forest or an undeveloped area, there shouldn't be much of a problem. It's the developed and developing areas that this plan is concerned with.

There are an estimated 150,000 homes in the State's mapped floodplains. Other than this statistic, there is little information available on the State's exposure to flooding. The only readily available statewide statistics are based on the number of flood insurance policies.

Flood insurance policies are only sold in communities that are participating in FEMA's National Flood Insurance Program (NFIP). Not all cities and counties are in the NFIP (38 out of 46 counties and approximately 155 cities participate). However, those that are in represent the vast majority of the communities with



flood problems. Participating communities are listed in Appendix A.

NFIP statistics are hard to relate to floodprone properties. In most communities, there are more buildings than policies. This is especially true inland where there is less awareness of the flood hazard. There really is no dependable way to extrapolate the total flood exposure from the number of flood insurance policies.

While not a basis for an accurate count of floodprone buildings, the number of flood insurance policies does represent where the hazards are and where the most properties are exposed. As of September 1998, there were over 105,000 policies in South Carolina (the State ranks sixth in the nation).

The greatest concentration of policies is on the coast. As summarized in Table 2-3, nearly 90% of the policies (and therefore nearly 90% of the exposure) is in three counties: the coastal population centers of Charleston, Myrtle Beach and Hilton Head Island (see Figure 2-8).

The two counties with the largest number of policies inland are Lexington and Richland, around Columbia, the largest population center in the State. These two counties have 2,500 policies compared to approximately 500 for both Greenville and Spartanburg Counties.

Even though the latter two counties combined have a greater population than Lexington and Richland Counties, they have only 20% of the flood insurance coverage. The hillier terrain in the northwest means narrower floodplains and less floodprone land with buildings on it.

<i>County</i>	<i>Flood Insurance Policies</i>	<i>Percent of State Total</i>
<i>Beaufort County</i>	<i>36,263</i>	<i>34.5%</i>
<i>Charleston County</i>	<i>35,617</i>	<i>33.9%</i>
<i>Horry County</i>	<i>21,136</i>	<i>20.1%</i>
<i>Georgetown County</i>	<i>4,727</i>	<i>4.5%</i>
<i>Colleton County</i>	<i>1,301</i>	<i>1.3%</i>
<i>Berkeley County</i>	<i>819</i>	<i>0.7%</i>
<i>Dorchester County</i>	<i>632</i>	<i>0.6%</i>
<i>Jasper County</i>	<i>176</i>	<i>0.1%</i>
<i>Total coastal counties</i>	<i>100,671</i>	<i>95.6%</i>

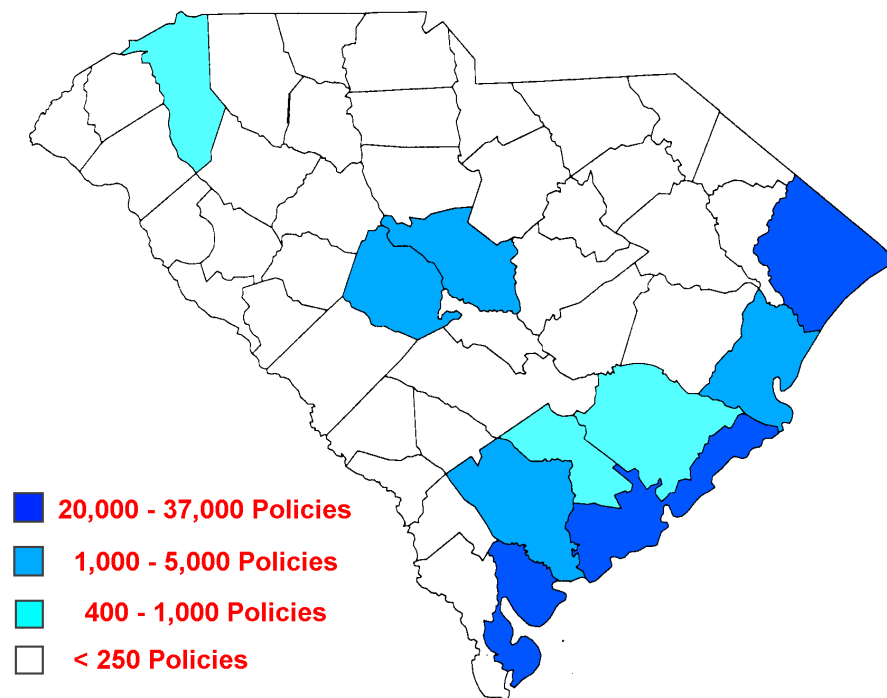
<i>County</i>	<i>Flood Insurance Policies</i>	<i>Percent of State Total</i>
<i>Total inland counties</i>	<i>4,582</i>	<i>4.4%</i>
<i>State total</i>	<i>105,253</i>	<i>100.0%</i>

**Table 2-3** *Distribution of Flood Insurance Policies*  
Source: National Flood Insurance Program, September 1998

**Figure 2-8** *Counties with the most NFIP policies*  
Source: National Flood Insurance Program

Another measure of flood problems is repetitive flood insurance claims. Communities with policies that have two or more claims (totaling over \$1,000 each) in a ten year period are considered repetitive loss communities by FEMA. FEMA encourages attention to repetitive loss because, while they comprise less than 3% of the policies, they account for over 30% of the claims.

As of October 15, 1998, South Carolina had 1,131 repetitive loss properties in 47 communities. These are listed in Table 2-4. Not surprisingly, most of the problems are in the coastal counties. 1,088 of the 1,131 repetitive loss properties are in coastal counties (96%).





<i>No. of County</i>	<i>Community Losses</i>	<i>No. of Buildings</i>	
Georgetown	Unincorporated areas	262	546
Horry	North Myrtle Beach	184	415
Horry	Unincorporated areas	171	384
Charleston	Charleston	133	336
Charleston	Folly Beach	46	114
Beaufort	Hilton Head Island	34	79
Charleston	Isle of Palms	34	79
Horry	Myrtle Beach	27	66
Charleston	Unincorporated areas	26	65
Charleston	James Island	25	56
Charleston	Mount Pleasant	22	60
Horry	Surfside Beach	22	53
Charleston	Sullivan's Island	22	48
Charleston	North Charleston	16	36
Beaufort	Unincorporated areas	13	34
Horry	Conway	11	26
Colleton	Edisto Beach	10	32
Florence	Unincorporated areas	9	20
Georgetown	Pawleys Island	8	17
Georgetown	Georgetown	6	18
Richland	Columbia	5	15
Berkeley	Hanahan	5	13
Greenville	Unincorporated areas	4	10
Lexington	Unincorporated areas	4	8
Greenville	Greenville	3	10
Jasper	Unincorporated areas	3	6
Marion	Unincorporated areas	3	6
Charleston	McClellanville	2	4
Darlington	Unincorporated areas	2	4
Dorchester	Unincorporated areas	2	4
Newberry	Newberry	1	7
Richland	Unincorporated areas	1	5
Charleston	Seabrook Island	1	3
Fairfield	Unincorporated areas	1	3
Kershaw	Camden	1	3
Beaufort	Beaufort	1	2
Chesterfield	Cheraw	1	2
Georgetown	Waccamaw Neck FD	1	2
Greenville	Mauldin	1	2
Lexington	Irmo	1	2
Marion	Mullins	1	2
Oconee	Unincorporated areas	1	2
Orangeburg	Orangeburg	1	2

Pickens	Unincorporated areas	1	2
Richland	Forest Acres	1	2
Spartanburg			Unincorporated areas 12
York	Rock Hill	<u>1</u>	<u>2</u>
Total		1,131	2,609

**Table 2-4** *Distribution of Repetitive Flood Insurance Losses*

*Source: National Flood Insurance Program*

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### ***3. State Mitigation Goal and Objectives***

#### ***3.1. Goal statement***

The Flood Hazard Mitigation Advisory Committee set one overall goal for its efforts:

*Protect the people and property of South Carolina from the dangers and damage caused by flooding.*

#### ***3.2. Vision***

The Committee defined its vision for the future in a series of descriptive statements:

- A. To ensure protection of people and property from flooding, the floodplains of the future will be limited to four types of uses:
  - 1. *Vacant, having natural and beneficial functions.* Undeveloped floodplains that were undeveloped in 1999 will remain preserved in or restored to an undeveloped natural state.
  - 2. *Vacant, low intensity development.* Large portions of the floodplain that do not have natural or beneficial floodplain functions will be reserved for forestry, agricultural, recreation and open space uses.
  - 3. *Infill urbanization.* Small portions of the floodplains that were vacant in 1998 will have been developed, but development will be limited to infill of vacant lots in existing urbanized areas and uses functionally dependent on waterfront locations, such as water transportation and tourism. In these cases buildings and infrastructure will be protected from damage by the base (100-year) flood and critical facilities will be protected from damage by the 500-year flood.
  - 4. *Already urbanized.* Buildings and infrastructure constructed before 1999 will be protected from flood damage in accordance with comprehensive local mitigation plans.
- B. Properties not in mapped floodplains but subject to local drainage problems will be protected from damage by shallow flooding.

- C. State and Federal agencies will work together to support this vision as they implement their programs and encourage and assist regional entities, local officials and property owners. Their work will be in accordance with this mitigation plan and guidance from a mitigation coordinating committee.
- D. Cities and counties will have their own comprehensive flood hazard mitigation plans that identify locally-appropriate measures to prevent and reduce flood losses. These plans and implementation of the measures will be coordinated with State, Federal, regional and private programs and with other communities in the watershed.

### ***3.3. Objectives***

The Committee identified seven objectives to reach this goal and vision.

- 1. Coordinate State and Federal flood mitigation programs so they will operate more effectively and efficiently.
- 2. Provide flood data and maps to support mitigation programs.
- 3. Regulate future development to prevent increasing flood hazards and losses.
- 4. Protect existing development from flood damage.
- 5. Provide warning and emergency response activities to protect lives and property during a flood.
- 6. Support and improve local mitigation programs.
- 7. Provide flood protection information to property owners.

#### 4. Possible Solutions:

##### *Mitigation Strategies and Measures*

This chapter reviews the variety of approaches to flood hazard mitigation. They are organized under six general strategies:

- ! Prevention - keeping things from getting worse
- ! Property protection - protecting things that will flood
- ! Natural resource protection - preserving beneficial floodplain uses
- ! Emergency services - actions taken during a flood
- ! Structural projects - controlling where floodwaters go
- ! Public information - helping people understand and help themselves

After a general discussion of each measure, there is a short section on “*Implementation in South Carolina*.” Where data are available, this section summarizes state and local programs that have experience with the measure.

There is not a lot of information on community implementation of many of the measures. The one program that affects most floodprone cities and counties is the National Flood Insurance Program, so NFIP data are used where appropriate.

The NFIP has a voluntary program that recognizes community mitigation activities beyond the minimum requirements for regulating floodplain development. There is more data on the 27 communities that have joined the NFIP’s Community Rating System (CRS). While only 27 communities, they have 80% of all the flood insurance policies in the State. They therefore represent those communities that must address the bulk of the State’s flood problem areas.

The 27 CRS communities are listed below. The asterisk (\*) notes that county programs only affect unincorporated areas. The references to CRS communities in this chapter are based on the 27 communities currently in the CRS.

Aiken County *	Georgetown	Myrtle Beach
Awendaw	Greenville	North Myrtle Beach
Beaufort	Greenville County *	Pickens County (4/1/99)
Beaufort County *	Hilton Head Island	Ravenel
Charleston County *	Isle of Palms	Richland County *
Charleston	Kiawah Island	Rockville (10/1/98)
Edisto Beach	Lexington County *	Seabrook Island
Florence	Meggett	Sumter County *
Folly Beach	Mount Pleasant	Sumter

## ***4.1. Prevention***

Prevention measures are designed to keep the problem from occurring or getting worse. They ensure that future development does not increase flood damage. Preventive measures are usually administered by building, zoning, planning, and/or code enforcement offices. They include:

- |                                      |                                  |
|--------------------------------------|----------------------------------|
| ! Planning and zoning                | ! Regulation of other facilities |
| ! Floodplain Open space preservation | ! Stormwater management          |
| ! Building construction regulations  |                                  |

### ***4.1.1 Planning and zoning***

Comprehensive plans and land use plans identify how a community should be developed (and where development should not occur). Use of the land can be tailored to match the land's hazards, typically by reserving flood hazard areas for parks, golf courses, backyards, wildlife refuges, natural areas, or similar uses.

Generally, a plan has limited authority. It reflects what the community would like to see happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and other land use controls. These plans and regulations guide land ownership and development patterns.

A community's capital improvement program identifies where major public expenditures will be made over the next 5 to 20 years. Capital expenditures may include acquisition of land for public uses, such as parkland, wetlands, or natural areas, and extension or improvement of roads and utilities. A capital improvement plan or program identifies where the public infrastructure will go to support the land use plan's development pattern.

A zoning ordinance regulates development and existing uses by dividing the community into zones or districts and setting development criteria for each district. The floodplain can be designated as one or more separate zoning districts that prohibit development or allow only development that is not susceptible to damage by flooding.

Appropriate districts include public use, conservation, agriculture, and cluster or planned unit developments that keep buildings out of the floodplain, wetlands, and other areas that are not appropriate for intensive development.

***Implementation in South Carolina:*** The Local Government Comprehensive Planning Enabling Act of 1994 requires all counties and cities to establish comprehensive plans as a precondition of enacting a zoning ordinance and other land use controls, such as subdivision, landscape and historic preservation regulations.

Local plans must cover seven elements, including community facilities and natural resources. While the latter may include floodplain information, there are no requirements that a plan address natural hazards. Technical assistance on the natural resources element is provided by the Department of Natural Resources, Land, Water and Conservation Division, Environmental Conservation Section.

The 1994 Act requires all plans to be done by May 1999. They must be updated every five years. To date, the majority of the counties (28 of 46) still do not have a plan, but most larger cities do.

***Recommendations:***

- ! Communities should include mitigation planning as part of their comprehensive planning process. Local plans should address natural hazards. If, after five years, plans are not addressing natural hazards, the 1994 Act should be evaluated to determine if any statutory changes to this advisory approach would be appropriate.
- ! Zoning and other land use planning maps and tax maps should show FEMA's base floodplains, Coastal Barriers, and other 100-year and 500-year floodplains where data are available.
- ! Zoning districts and other land development regulations in floodprone areas should allow only uses appropriate for the hazard, such as open space, low density development, and water dependent uses.

***4.1.2 Floodplain open space preservation***

Keeping the floodplain free from development is the best approach to preventing flood damage. Keeping floodprone lands open also provides recreation and habitat benefits. Open space preservation should not be limited to floodplains, as some sites in the watershed may be key to controlling runoff that contributes to flooding.

Land use and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made if the owner agrees to not build on the floodprone part or the part set aside in the easement.

Open space lands and easements do not always have to be purchased. Developers can be required to dedicate park land and flood flow, drainage, or maintenance easements. These are usually linear parcels along property lines or channels. Maintenance easements also can be provided by streamside property owners in return for a community channel maintenance program.

This was done on a large scale following the 1993 Midwest floods. Federal programs funded the purchase of flood easements whereby areas were reserved for compatible uses, such as grazing, wildlife habitat and hunting clubs that are not affected by flooding.

***Implementation in South Carolina:*** Many communities have parks, beaches and similar properties preserved as open space in the floodplain. Twenty-one CRS communities are credited with preserving some areas of floodprone open space. These range from at least five acres of park to Hilton Head Island's program. Over the past 8 years, Hilton Head Island raised nearly \$35 million for the purchase of open space through bond issues, grants, property taxes and real estate transfer taxes.

There are several programs, such as land trusts and the Farmland Protection Act, that help finance or provide financial incentives to encourage property owners to set aside open land through easements or sales. Sullivan's Island deeded 80 acres of beach front land to the Open Land Trust which put restrictions on the deed. The land cannot be changed without approval of 75% of the voters.

In more rural areas, where land is less expensive, owners tend to be more willing to donate or accept limits on their rights to develop their lands. More than 40,000 acres in the Ashepoo, Combahee and Edisto river basins were preserved as open space when their owners donated their development rights to land trusts. The Columbia area will benefit from the new Three Rivers Greenway.

A proposed bill, the Farm and Forest Land Protection Act, would allow communities to purchase development rights from farmers. It did not pass in 1998, but another version is expected to be introduced in the future.

***Recommendation:*** Communities should become more aware of the benefits of preserving open space and available financial assistance programs.

#### ***4.1.3 Building construction regulations***

Zoning and open space preservation work to keep damage-prone development *out* of the hazardous or sensitive areas. Building construction and special use regulations impose construction standards on what is allowed to be built *in* the floodplain. The latter is discussed in the next section. Both protect projects from flood damage and prevent the development from aggravating the flood problem. The two most common types of building regulations are building codes and separate "stand alone" floodplain ordinances.

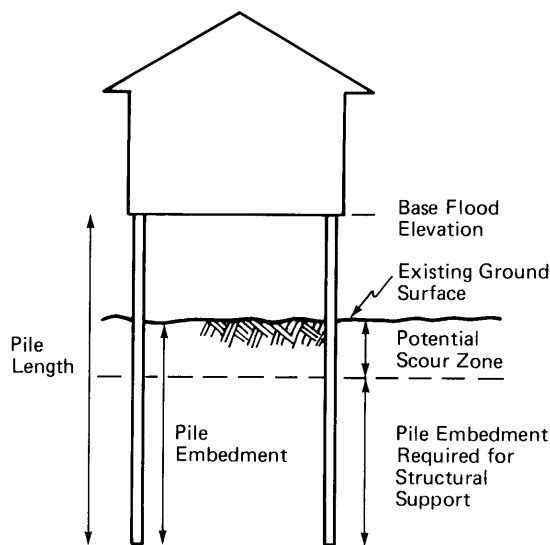
***Building codes:*** Flood protection standards for all new and improved or repaired buildings can be incorporated into the building code. These should include criteria

to ensure that the foundation will withstand flood forces and that all portions of the building subject to damage are above, or otherwise protected from, flooding.

**Implementation in South Carolina:** Under a new 1997 law, all municipalities and counties must adopt the latest editions of the Standard Building Code published by the Southern Building Code Congress International and the One and Two Family Dwelling Code of the Council of American Building Officials.

Local governments must appoint or contract a building official. Larger communities must comply within one year, medium size communities (populations between 35,000 and 70,000) have two years, and small communities have three years.

Implementation of the law at the state level is the responsibility of the Department of Labor, Licensing and Regulations' Building Codes Council. The Department of Insurance has an Advisory Committee to this Council which is charged "to study issues associated with the development of strategies for reducing loss of life and mitigating property losses due to hurricane, earthquake and fire." The Committee members represent key State agencies, researchers and building associations.



**Figure 4-1** A coastal building code needs to address water, wind, waves, velocity and erosion.

**Floodplain ordinances:** The National Flood Insurance Program (NFIP) sets minimum requirements for participating communities' building construction regulations. These are usually spelled out in a separate ordinance. The NFIP minimum requirements are summarized in the box on the next page.

Communities are encouraged to adopt ordinances which are more comprehensive or provide more protection than the FEMA criteria. This is especially important in areas with older maps that may not reflect the current hazard. These could include counting improvements and repairs cumulatively, prohibiting certain types of high damage-prone uses from the floodway, or requiring structures to be elevated one or more feet above the base flood elevation.

*The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities agree to regulate new construction in the base floodplain.*

*There are five major floodplain regulation requirements. Additional floodplain regulatory requirements may be set by state and local law.*

1. All **development** in the base floodplain must have a permit from the community. **Agricultural and forestry activities are not exempt.**
2. Development should not be allowed in the floodway. The floodway is the channel and central portion of the floodplain that is needed to convey the base flood. It is usually the most hazardous area of a riverine floodplain and the most sensitive to development. At a minimum, no development in the floodway can cause an obstruction to flood flows. Generally an engineering study is needed to determine if this will happen.
3. New buildings may be built in the floodplain, but they must be protected from damage by the base flood. The lowest floors of residential buildings must be elevated to or above the base flood elevation. Nonresidential buildings must be elevated or floodproofed.

*"Development" is defined as any man-made change to the land, including new buildings, improvements to buildings, filling, grading, mining, dredging, etc.*

**Figure 4-2** *Minimum NFIP Floodplain Construction Regulations*

**Implementation in South Carolina:** There are 194 cities and counties in the NFIP and 29 cities and counties with FEMA floodplain maps that have not joined. Generally, all communities with a significant flood problem have joined. All 194 cities and counties in the NFIP have regulations on the books that meet the minimum NFIP and state building construction requirements.

Manufactured homes must meet the same NFIP floodplain requirements as “stick built” housing. As residential buildings, they must be elevated above the base flood elevation. When elevated more than three feet above grade, they must be on engineered foundations. Otherwise, manufactured homes are installed according to the manufacturer’s instructions.

Several problems have been identified with local implementation of building construction regulations:

1. Communities not in the NFIP do not have a regulatory program.
2. Experience has shown that passing the NFIP ordinance and enforcing it are two different things. The Department of Natural Resources’ Flood Mitigation Office visits communities and evaluates the administration of their ordinances. Many communities, especially those with little floodplain development activity, have difficulty ensuring that every requirement is met. They need trained staff and political support to back them up when the staff has to say “no.”
3. There are a few training programs for local officials. The Flood Mitigation Office conducts some and FEMA’s Emergency Management Institute has some. The latter requires the community to allow staff to spend a week in Maryland, something difficult to do for a person who is needed on the job. There is currently no program that recognizes whether a local official is qualified to do the job.
4. The Standard Building Code’s flood criteria are in a separate “associated codes” publication, a place not always used by local building officials. Many communities have a separate floodplain ordinance for the NFIP. As a result, local building officials may not be aware of the extra requirements for building in a floodplain.
5. These requirements may or may not provide sufficient protection in every community. Communities are somewhat limited on how much they can exceed the minimum requirements. Regulations that effectively prohibit a property owner from getting any use of his land are considered a “taking” under the U.S. Constitution. A landmark U.S. Supreme case, *Lucas vs. South Carolina Coastal Council*, reminded everyone of this concern (although many have misinterpreted the ruling to mean there can be no regulation).

Communities can exceed the minimum requirements (the NFIP regulations are only minimums) and many do. Twenty-one CRS communities have enacted regulatory standards that are more restrictive than the minimum NFIP criteria. The most common higher standards are freeboard (requiring a building to be protected to a level higher than the 100-year flood) and specific

requirements for foundation construction and fill compaction. Some CRS communities count improvements cumulatively, restrict the location of critical facilities, prohibit filling or require compensatory storage.

6. Construction of some buildings are exempt from local regulations. Many Federal and state agencies can build in the floodplain without obtaining a local permit (e.g., construction of highways). However, Presidential Executive Order 11988 and Governor's Executive Order 82-19 requires them to meet or exceed the NFIP construction standards. Monitoring compliance with these provisions is as difficult as monitoring local enforcement.

***Recommendations:***

- ! All floodprone communities should be encouraged and assisted to join the National Flood Insurance Program.
- ! Communities should be provided with more assistance and training to help them enforce their floodplain regulations.
- ! Training on floodplain management should be coordinated with training on other hazards and training for other professionals.
- ! There should be more incentives for officials to attend training, such as including floodplain management topics in the training programs mandated for engineers and building officials and floodplain management certification for local regulatory officials.
- ! The current guidelines for local regulations and state building code standards should be reviewed to determine if they should be revised to better protect floodprone properties.

***4.1.4 Regulation of other facilities***

Buildings are not the only things that can be built in the floodplain. Other facilities, such as roads, farms and utility lines, can also be damaged, obstruct flood flows and/or cause other public health or safety problems. Most of these facilities are regulated locally through subdivision regulations. The more complicated ones are regulated directly by state agencies.

Subdivision and other land development regulations govern how land will be subdivided into individual lots. They set construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers and drainageways. These regulations should be based on the

development patterns set by the comprehensive plan (see Section 4.1.1). They often require that every lot have a buildable area above the flood level.

***Implementation in South Carolina:*** All cities and counties are empowered to enact and enforce subdivision regulations.

State agency activities are to comply with a 1982 Governor's Executive Order and their own statutory mandates. The Executive Order required state-owned properties to be built to standards similar to the NFIP requirements (see Figure 4-2).

The following state agencies regulate development of other facilities:

- ! The Budget and Control Board's General Services manages state-owned buildings.
- ! The Budget and Control Board's State Engineer is Chair of the Variance Committee for state construction and is charged with overseeing compliance with the Governor's Executive Order.
- ! The Department of Education oversees school construction.
- ! The Department of Archives and History must approve the modification of historical structures.
- ! The Department of Labor Licensing & Regulations' Manufactured Housing Board sets regulations for placement of manufactured homes.
- ! DHEC's Bureau of Health Facilities and Services Development sets construction standards for hospitals, nursing homes, and critical and long term care facilities.
- ! DHEC's Bureau of Solid & Hazardous Waste Management regulates landfills and mining.
- ! DHEC's Office of Environmental Quality Control regulates the construction of public swimming facilities, public drinking water systems, and wastewater treatment plants.
- ! DHEC's Agricultural Facilities and Operations regulates hog farm and similar operations.
- ! The Department of Corrections constructs and maintains correctional facilities.

Only the last two programs have specific standards for construction in a floodplain. DHEC requires wastewater treatment plants to be protected from a 25-year flood, a lesser level than the NFIP requires. Hog farm settling pits and lagoons must be located outside of the 100-year floodplain.

The rest of the programs have no specified flood protection standards but the activities regulated may be exempt from the standards in a local NFIP ordinance. For example, most communities do not have the authority to regulate another local government. A county hospital or a local school may not have to comply with a city's floodplain regulations.

***Recommendation:*** The current regulatory programs and standards, including the 1982 Governor's Executive Order, should be reviewed to determine if they should be revised to better protect floodprone properties and public health and safety. For example, all new state buildings that could be used as emergency shelters should be built to withstand damage from a 500-year flood or category 4 hurricane, a standard higher than the NFIP requirements.

#### ***4.1.5 Stormwater management***

Development outside a floodplain can contribute significantly to flooding problems. Runoff is increased when natural ground cover is replaced by urban development. Unconstrained watershed development often will aggravate downstream flooding and overload the community's drainage system. Effective stormwater management policies require developers to build retention and detention facilities.

Usually part of a subdivision ordinance, these regulations require developers to build retention or detention basins to minimize the increases in runoff caused by impervious surfaces and new drainage systems. Generally, new development must not let stormwater leave at a rate higher than under pre-development conditions.

Many developments utilize wet basins as landscaping amenities. In some cases, watershed planners identify the most effective location for a basin. Communities then require developers to contribute funds for a regional facility in lieu of constructing on-site detention.

In addition to local subdivision regulations, any development greater than 2 acres that wants to bring runoff to a highway drainage system, must have a stormwater management plan approved by the State Department of Transportation. If the area is less than 2 acres, the developer must show that the post construction 10-year peak discharge does not exceed the pre-development 10-year peak.

Since detention only controls runoff rates, and not runoff volumes, there is a need for other measures to enhance the infiltration of stormwater. Swales, infiltration trenches, vegetative filter strips, and permeable paving blocks are recommended additions to the standard detention requirements.

Some state and regional agencies have minimum regulatory standards that all communities and developers must follow. Some areas fund stormwater projects with utility or user fees, which each property in the watershed pays according to the amount of runoff it generates.

**Implementation in South Carolina:** Pursuant the Stormwater Management and Sediment Reduction Act, DHEC has set minimum standards for runoff to improve water quality. Developments of five or more acres must manage the 10-year storm and meet standards to comply with the US Environmental Protection Agency's National Pollution Discharge Elimination System (NPDES). Agriculture, forestry, mining, and public utilities are exempt or subject to other regulatory requirements.

Communities are authorized to enact and enforce stormwater management regulations. Twenty-three CRS communities receive credit for stormwater management regulations. Most of them are no more restrictive than the DHEC criteria.

DHEC's Office of Environmental Quality Control monitors implementation of this requirement. However, this office averages one staff person for three counties and is unable to ensure full compliance.

**Recommendation:** The current DHEC standards and guidelines for local regulations should be reviewed to determine if they should be revised to better manage stormwater runoff onto downstream properties.

## ***4.2. Property protection***

Property protection measures are used to modify buildings or other facilities subject to flood damage rather than to keep floodwaters away. A community may find these to be inexpensive measures because often they are implemented by or cost-shared with property owners. Many of the measures do not affect the buildings' appearance or use, making them particularly appropriate for historical sites and landmarks.

Property protection measures include:

- |                      |                       |
|----------------------|-----------------------|
| ! Relocation         | ! Floodproofing       |
| ! Acquisition        | ! Lifeline protection |
| ! Building elevation | ! Insurance           |

### ***4.2.1 Relocation***

Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier or rigid structures, such as those made of brick, and for large or irregularly shaped buildings. Experienced house movers know how to handle any job.

Communities with areas subject to coastal storm surge, ice jams, flash flooding, deep waters or other high hazard where the only safe approach is to remove the building should consider a relocation program. Relocation is also preferred for large lots with portions outside the floodplain or where the owner has a new flood-free lot available.

Relocation can be expensive. The cost can average \$25,000 and exceed \$50,000 depending on the type, weight and size of the house, the distance moved, whether it has to be cut and moved in parts, and the cost of a new lot. However, there may be some government loans or grants available.

***Implementation in South Carolina:*** In the early 1990's a benefit under the National Flood Insurance Program known as "Upton-Jones" paid to relocate buildings in immediate danger of collapse due to coastal erosion. There were only 13 claims for these projects in South Carolina. At least one building was physically relocated, but most were demolished.

This program did not have more takers, primarily because people did not want to leave their beach front sites. The Upton Jones program has since been replaced by the Flood Mitigation Assistance program, operated by DNR, which is too new to have gained any experience in relocation.

***Recommendation:*** Communities and property owners should be advised of available funding sources for relocation projects.

#### ***4.2.2 Acquisition***

Like relocation, acquisition ensures that buildings in a floodprone area will cease to be subject to damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public use, such as a park.

Acquiring and clearing buildings from the floodplain is not only the best flood protection measure available, it is also a way to convert a problem area into a community asset and obtain environmental benefits.

Occasionally acquisition and relocation projects are undertaken jointly. The purchasing agency sells the building for salvage and the new owner relocates the structure rather than demolish it. Sometimes arrangements are made to allow the previous owner to buy back the building at the salvage value. This way, the owner gets to keep the house but have enough money from the sale to pay for a new lot and moving expenses.

While acquisition works against any type of flood hazard, it is more cost-effective in areas subject to storm surge, ice jams, flash flooding, deep waters, or other severe flood hazards where other property protection measures are not feasible. Acquisition, followed by demolition, is most appropriate for buildings that are too expensive to move -- such as larger, slab foundation, or masonry structures -- and for dilapidated structures that are not worth protecting.

**Implementation in South Carolina:** As mentioned in the previous section, a few buildings were paid for and demolished under FEMA's Upton Jones program. Only one CRS community, the City of Greenville, has been recognized as having acquired or relocated floodprone buildings.

The major program for acquisition, FEMA's Hazard Mitigation Grant Program, is available only after a Presidential Disaster Declaration. Once cleared, the land is turned over to a local public agency and kept forever as open space.

These declarations have been limited to coastal areas where people resist leaving, so there have been very few Federally funded acquisition projects in South Carolina. The post-Hugo mitigation strategy also concluded that it is very hard, if not impossible to acquire beach front properties.

**Recommendation:** Communities should be encouraged and assisted in acquiring floodprone sites appropriate for clearance and reuse.

### 4.2.3 Building elevation

Raising a house above the flood level is the best on-site property protection method. Water flows under the building, causing little or no damage to the structure or its contents. Another alternative is to raise the building and place fill under it before the building is lowered back down, although sometimes buildings on fill look safe and people may feel encouraged to stay in them during a flood.

Elevating a structure will change its appearance. If the needed degree of flood protection is low, the result is similar to putting a house on a two or three-foot crawlspace. If the house is raised two feet, the front door would be three steps higher than before. If the house is raised eight feet, codes will usually allow the lower area to be wet flood-proofed for use as a garage and for limited storage of items not subject to flood damage.



**Figure 4-3** The house on the right was elevated well above the 100-year flood level after it had been flooded several times.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Commonly practiced in flood-prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a floodplain. House moving contractors know the techniques to elevate a building.

During flooding, the building may be isolated and without utilities, and therefore unusable. Another problem arises when newly created lower stories are occupied or used for storage, putting household goods at risk for flood damage.

In addition to cost, three factors may limit use of elevation as a property protection approach:

- ! Regulatory restrictions, such as the Americans with Disabilities Act (ADA) and historic preservation rules,
- ! Resistance to the appearance of an elevated building, and
- ! The need to incorporate wind and seismic protection measures to ensure that the flood protection project does not increase the building's vulnerability to other hazards.

***Implementation in South Carolina:*** Many new buildings are elevated above flood levels. Following Hurricane Hugo and other disasters that substantially damaged buildings, local NFIP ordinances required many older buildings to be elevated (see Figure 4-2, item 5 on the substantial damage requirement).

A unique project is underway in Charleston. An historic building at 113 Calhoun Street is being elevated to protect it from flooding and storm surge. ADA and historic preservation requirements limit the elevation to only seven inches, but the design engineers calculated that that will capture 60% of the total benefit of elevating to the base flood elevation. The demonstration project will also incorporate wind and seismic design measures.

***Recommendation:*** Communities and property owners should be advised of the benefits of elevation and available funding sources for elevation projects.

#### ***4.2.4 Floodproofing***

If a building cannot be removed from harm's way, it can be protected on site. In areas of low flood threat, such as infrequent low velocity shallow flooding, barriers and dry and wet floodproofing can be efficient approaches. These approaches can also be less disruptive to a neighborhood. However, floodproofing a residential building does not qualify for an insurance premium reduction and is not allowed if the project is a substantial improvement or repair of substantial damage.

It must be remembered that during a flood, the building may be isolated and without utilities, and therefore unusable. The streets, utilities and other infrastructure that serve the property will still be exposed to flood damage. This is also a risk to the occupants who may try to get in and out of the building during a flood.

**Barriers:** Levees, floodwalls and berms keep floodwaters from reaching a building. They are useful only in areas subject to shallow flooding. They can surround the entire building, tie into high ground, or be as small as a low floodwall built around a stairwell to protect a basement or split-level home. Care must be taken in locating barriers. They must be placed so as not to create flooding or drainage problems on neighboring properties. All barriers must be kept out of the floodway and coastal high hazard area.

**Dry floodproofing:** Through dry floodproofing, a building is sealed against floodwaters. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, sewer lines and vents, are closed, either permanently with removable shields, or with sandbags.

The flood protection level should be no more than 2 or 3 feet above the top of the foundation because the building's walls and floors may not withstand the pressure of deeper water. If a nonresidential building is dry floodproofed to one foot above the base flood elevation, there is a flood insurance rate reduction.

**Wet floodproofing:** This approach is usually considered a measure of last resort as floodwaters are intentionally allowed into the building to minimize pressures on the structure. Wet floodproofing techniques can be as simple as moving a few valuable items or as involved as rebuilding the floodable area.

Wet floodproofing has one advantage over the other approaches: No matter how little is done, flood damage will be reduced. Thousands of dollars in damage can be prevented by simply moving furniture and electrical appliances out of the floodprone area.

**Sewer backup protection:** In areas where sanitary and storm sewers are combined, basement flooding can be caused by stormwater overloading the system and backing up into the basement through the sanitary sewer line. In areas where sanitary and storm waters are carried in separate pipes, the same problem can be caused by cross connections between the storm and sanitary sewers or infiltration or inflow into the lines.

Houses which have downspouts, footing drain tile, and/or the sump pump connected to the sanitary sewer service may be inundated when heavy rains overload the system. If allowed by the local code, these should be disconnected. Rain and ground water should be directed out onto the ground, away from the building.

Four other approaches may be used to protect a structure against sewer backup: floor drain plug, floor drain standpipe, overhead sewer, and sewer backup valve. The first two devices keep water from flowing out of the lowest opening in the house, which is the floor drain. They cost less than \$25. However, if the water gets deep enough in the sewer system, it can flow out of the next lowest opening in the basement, such as a toilet or laundry tub.

The latter two devices are more secure, but more expensive. An overhead sewer keeps water in the sewer line during a backup. A backup valve allows sewage to flow out while preventing backups from flowing into the house.

In areas without sewers, flooding of septic systems causes a health hazard because they do not work when underwater. Because they are usually lower than the building, they seldom back up. When they do, the sewer backup measures described above prevent sewage backing up into the building.

***Implementation in South Carolina:*** Because these measures are usually not adequate to protect buildings from coastal flooding, they are primarily appropriate for inland areas. The lesser interest in inland flooding has meant that there are few known examples of floodproofed buildings.

***Recommendation:*** Communities and property owners should be advised of the benefits of elevation and available funding sources for floodproofing projects.

#### ***4.2.5 Lifeline protection***

“Lifelines” include roads, railroads, pipelines, power lines, and other utility systems that are used for transportation or communication. They are vital to an area's economic base and, depending on the situation, can be vital for public health and safety. It is estimated that the Department of Transportation alone is responsible for 7,500 bridges and culverts.

In most cases, well constructed lifelines can resist the effects of flooding, especially shallow, slow moving floodwaters. However, high velocity flows can scour and undermine bridges and transmission structures and expose underground pipes.

Protection measures vary according to the facility and flood conditions. Well-known engineering practices, such as proper siting and deeper foundations, can

protect a new or existing facility, provided there is recognition of the full potential of the hazard.

**Implementation in South Carolina:** Each agency, utility company or organization has its own program for maintaining and correcting its floodprone lifelines.

**Recommendation:** Agencies and organizations responsible for lifelines, such as utility companies, should be invited to participate in all state-wide hazard mitigation meetings and training to ensure that they are aware of the hazards and their protection measures are coordinated with other mitigation activities.

#### **4.2.6 Insurance**

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. While most homeowner's insurance policies do not cover a property for flood damage, there are two ways an owner can insure a building: National Flood Insurance and basement backup insurance.

**National Flood Insurance:** A community must join the National Flood Insurance Program (NFIP) in order to make flood insurance available to its residents. Community participation allows any local insurance agent to sell a separate flood insurance policy under rules and rates set by FEMA's Federal Insurance Administration. Rates do not change after claims are paid; they are set on a national basis.

The NFIP has a new provision, "Increased Cost of Compliance," wherein an additional claim payment is made to help cover the cost of mitigation measures needed to bring a substantially damaged building up to code.

**Private flood insurance:** There are a few private insurance companies that market flood insurance. Generally, these are for more expensive buildings needing more coverage than the limits set by law for the NFIP. Other private policies are for special cases, such as condominiums, coverage in communities that don't participate in the NFIP, or for buildings in designated coastal barriers where NFIP insurance is not available (see Section 4.3.4).

**Sewer backup insurance:** National Flood Insurance covers seepage and sewer backup for an additional deductible provided there is a general condition of flooding in the area which was the proximate cause of the backup. Several insurance companies offer coverage for damage incurred should a sump pump fail or a sewer line or septic system back up. Most exclude damage from surface flooding that would be covered by the NFIP. Each company has different amounts of coverage, exclusions, deductibles, and arrangements.

**Implementation in South Carolina:** There are over 105,000 NFIP flood insurance policies in South Carolina, making it sixth in the nation in the number of policies in force. As noted in Table 2-3, 95.6% of the policies are in the eight coastal counties. Total coverage is for \$13 billion.

Since 1978, there have been over 22,000 claims paid for a total of over \$387 million. The average claim was for \$17,500, most of them as a result of Hurricane Hugo. There are no available statistics on sewer backup insurance.

**Recommendation:** Property owners and insurance agents should become more familiar with flood and sewer backup insurance.

### ***4.3. Natural resource protection***

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas produce flood loss reduction benefits as well as improve water quality and habitats. These activities are usually implemented by parks, recreation, or conservation agencies or organizations. In addition to the four measures listed here, other measures, such as zoning and preservation of open space can also protect natural resources.

- |                                |                              |
|--------------------------------|------------------------------|
| ! Wetland protection           | ! Best management practices  |
| ! Erosion and sediment control | ! Coastal barrier protection |

#### ***4.3.1 Wetlands protection***

Wetlands are often found in floodplains or depressional areas in the watershed. Many can store large amounts of floodwaters, slowing and reducing downstream flows. They also filter water and provide habitats for fish and wildlife. Most development projects in wetlands are regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Corps “404” permits are required for projects that will place fill or dredged materials in a wetland.

Before a permit is issued, the plans are reviewed by several agencies, including the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency. The Natural



**Figure 4-4** *Wetlands have natural resource and flood mitigation benefits.*

Resources Conservation Service is responsible for identifying wetlands on agricultural lands.

Generally, these agencies want to protect wetlands by preventing development that will adversely affect them. However, sometimes the negative impact can be mitigated by preserving or developing an equivalent or larger wetland on another site. In most cases creating new wetlands should be avoided, as it takes many years for a new wetland to become of the same quality as an existing one. Another drawback is that a new wetland in a different location (especially if it's in a different drainage basin) will not have the same flood protection benefits as the original one did.

Many states and some communities also have their own wetland protection programs. Local programs should address the gaps in the State or Federal regulations, particularly for smaller wetlands and unregulated activities.

***Implementation in South Carolina:*** The extent of wetland protection regulations differs greatly between the eight coastal counties and upstate areas. The coastal counties have separate regulatory authority and maps from the National Wetlands Inventory. The Inventory has not yet mapped upstate wetland areas.

DHEC and DNR review and comment on development plans before the Corps issues a 404 permit. The state agencies have no authority to veto or alter a proposed permit. However, there are good relations and cooperation with the Corps' program and state recommendations are often accepted.

***Recommendation:*** National Wetlands Inventory or other wetland identification maps should be prepared for the balance of the state to facilitate wetland protection regulations.

#### ***4.3.2 Erosion and sediment control***

Because farmland and construction sites are usually bare, stormwater runoff can erode soil, sending sediment into downstream waterways. Sediment tends to settle where the river slows down, such as when it enters a lake. Sedimentation will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. Not only are the drainage channels less able to do their job, but the sedimentation in the water reduces light, oxygen, and water quality which affects water supply treatment, habitat and silviculture.

Practices to reduce erosion and sedimentation on farms and construction sites have two principal components: minimize erosion and capture sediment before it leaves the site. Slowing runoff on the way to a drainage channel increases infiltration into the soil and controls the loss of topsoil from erosion and the

resulting sedimentation. Runoff can be slowed down by measures such as vegetation, terraces, contour strip farming, no-till farm practices and impoundments (sediment basins, farm ponds, wetlands, etc.).

**Implementation in South Carolina:** The Sediment and Erosion Control Act of 1991 sets erosion and sediment control requirements for all construction projects greater than two acres. It is administered by DHEC, but communities can implement their own regulations if their standards meet or exceed DHEC's. All but one of the CRS communities are receiving credit for this requirement. As it excludes agriculture and forestry, its primary impact is on new construction sites.

**Recommendation:** All construction projects should comply with the current regulations on erosion and sediment control. Communities should be encouraged to adopt more restrictive regulations where local conditions warrant.

#### ***4.3.3 Best management practices***

Nonpoint source pollutants are carried by stormwater (point source pollution comes from municipal and industrial wastewater systems). They include lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry.

Best management practices ("BMPs") are measures that reduce nonpoint source pollutants that enter the waterways. Unlike erosion and sediment controls which focus on problems created during construction, BMPs can also be implemented as part of a project's design to permanently address nonpoint source pollutants.

There are two general categories of BMPs:

- ! Those that prevent runoff that conveys sediment and other water-borne pollutants, such as planting proper vegetation and conservation tillage, and
- ! Those that stop pollutants after they are en route to a stream, such as grass drainageways that filter the water and retention and detention basins that let pollutants settle to the bottom before they are drained.

In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm. Combining water quality and water quantity measures can result in more efficient multi-purpose stormwater facilities.

Because of the need to clean up our rivers and lakes, there are several state and Federal laws mandating the use of best management practices for new developments and various land uses. Specific BMPs and structural measures may



be required on industrial sites, mined lands, construction sites, farms, forested areas, and high use public lands.

***Implementation in South Carolina:*** BMPs are required on construction and mining sites as described in the previous section on erosion and sediment control. Otherwise, mandates are limited to communities subject to the U.S. EPA's NPDES requirements.

The U.S. Natural Resources Conservation Service (NRCS), soil and water conservation districts and the Department of Natural Resources provide advice and encouragement to farmers and other landowners. A recent Department of Natural Resources' publication, *Farming for Clean Water in South Carolina*, provides examples of BMPs for agricultural areas. The NRCS can now tie USDA financial aid programs for farmers to their willingness to incorporate BMPs in their farming techniques.

Elsewhere, getting property owners and developers to incorporate BMPs in their practices is primarily an educational effort. The State Forestry Commission is known for its aggressive promotion of BMPs on forest lands. There is now a trend seen where more forestry companies are voluntarily adopting BMPs.

The DNR's Stewardship Development Program provides technical assistance to those involved in the land development process on how to lessen the impact of the project on the natural environment. The program is preparing a handbook describing the stewardship design process and various stewardship (conservation) concepts. Floodplain protection is a consideration in the program's technical assistance aspects and is a topic in the proposed guidelines anticipated in 1999.

***Recommendations:***

- ! All people and companies involved in agriculture, forestry, and land development should be advised of the need for protecting water quality and of appropriate best management practices.
- ! Communities should be encouraged to adopt more restrictive water quality regulations where local conditions warrant.

***4.3.4 Coastal barrier protection***

Coastal barriers include islands and shoreline landforms that are made mostly of sand. They are low-lying and highly vulnerable to coastal flooding and storms. They can move over a period of a few decades in response to the forces of winds and waves. Because of their location, they are subject to some of the strongest development pressures in the country.

Protecting coastal barriers from development is important to both habitat and inland human development. Barrier islands provide enclosures for estuaries and marshes which are home to a variety of plant and animal life, including a number of endangered species. Coastal barriers provide recreational and aesthetic benefits. They are the “first line of defense” for inland properties against coastal storms.

***Implementation in South Carolina:*** South Carolina has 153 miles of coastal barriers, although much of it is already developed. The Coastal Barriers Resources Act (known as “COBRA”) is a Federal law that identifies undeveloped coastal barriers. Once designated, Federal assistance, including National Flood Insurance, is denied to buildings and other facilities built after the date of designation. This prohibition also extends to infrastructure, such as publicly funded roads, water supply systems and wastewater treatment plants.

Communities are still free to allow construction, although the owners take a big risk without Federal assistance or flood insurance. This has reduced, but not stopped, construction on undeveloped coastal barriers.

***Recommendation:*** Local regulations should prohibit inappropriate development in designated undeveloped coastal barriers.

#### ***4.4. Emergency services***

Emergency services measures protect people during and after a flood. Most counties and many cities have emergency management offices to coordinate warning, response, and recovery during a disaster. Measures include:

- |                            |   |
|----------------------------|---|
| ! Flood threat recognition | ! Critical facilities protection        |
| ! Warning dissemination    | ! Health and safety maintenance         |
| ! Flood response           | ! Post-disaster recovery and mitigation |

##### ***4.4.1 Flood threat recognition***

The first step in responding to a flood is knowing that one is coming. A flood threat recognition system provides early warning to emergency managers. A complete system measures rainfall, snow conditions, soil moisture, and stream flows upstream in order to calculate the time and height of the flood crest downstream.

On many rivers, the flood threat recognition work is done by the National Weather Service (NWS). Communities on smaller streams that want specific flood threat

data must develop their own systems. They may install rain and river gauges in key locations, then gather data from them electronically or manually.

***Implementation in South Carolina:*** The U.S. Geological Survey operates gaging stations, both on the coast and on major rivers. The NWS can access these and other gages to develop real time flood threat data.

The Weather Service issues River Flood Watches and River Flood Warnings with the estimated time and height of the flooding at gage locations throughout the State. The Department of Natural Resources is working to increase the number of accessible gages in the State.

NWS warnings relate to flood stage. This is the height where floodwaters will start to cause property damage. It is a number that varies from gage to gage and the stages at various gages are not related to each other (see Table 4-1). River Flood Warnings are issued when the stage is forecasted to reach flood stage within 24 hours. River Flood Watches are issued if the river will reach flood stage after 24 hours.

On streams without forecast points, the Weather Service issues Flash Flood Watches and Warnings when flooding is expected within 6 hours after the heavy rains begin. The NWS can provide technical assistance to communities and regional agencies that want to establish local flood warning systems.

Local flood warning systems have been established in Anderson, Greenville and Spartanburg Counties using the IFLOWS system in cooperation with systems in North Carolina. A pilot local flood threat recognition system is being developed in Lexington County. It will use river gage, rain gage and Doppler radar data to identify flood threatening conditions on the smaller streams. Another pilot is being developed on Mill Creek in Richland County.

***Recommendations:***

- ! The DNR and other agencies should continue to expand the gaging system that can be used by the National Weather Service to provide real time data for flood threat recognition.
- ! The results of the pilot local systems should be reviewed and publicized to other floodprone communities.
- ! Communities should work to establish local flood warning systems on a watershed basis.

<i>River</i>	<i>Forecast Station</i>	<i>Zero Datum *</i>	<i>Flood Stage</i>
<i>Black</i>	<i>Kingstree</i>	<i>25.66</i>	<i>12</i>
<i>Broad</i>	<i>Blair</i>	<i>249.86</i>	<i>19</i>
<i>Broad</i>	<i>Gaffney</i>	<i>539.10</i>	<i>10</i>
<i>Congaree</i>	<i>Carolina Eastman</i>	<i>0.0</i>	<i>115</i>
<i>Congaree</i>	<i>Columbia</i>	<i>113.02</i>	<i>19</i>
<i>Edisto</i>	<i>Orangeburg</i>	<i>149.02</i>	<i>8</i>
<i>Edisto</i>	<i>Givhans Ferry</i>	<i>20.46</i>	<i>10</i>
<i>Little Pee Dee</i>	<i>Galivants Ferry</i>	<i>23.95</i>	<i>9</i>
<i>Lynches</i>	<i>Effingham</i>	<i>58.49</i>	<i>14</i>
<i>Pee Dee</i>	<i>Cheraw</i>	<i>56.92</i>	<i>30</i>
<i>Pee Dee</i>	<i>Pee Dee</i>	<i>24.73</i>	<i>19</i>
<i>Reedy</i>	<i>Greenville</i>	<i>908.91</i>	<i>8</i>
<i>Saluda</i>	<i>Chappels</i>	<i>362.89</i>	<i>14</i>
<i>Saluda</i>	<i>West Pelzer</i>	<i>689.73</i>	<i>9</i>
<i>Santee</i>	<i>Jamestown</i>	<i>0.0</i>	<i>10</i>
<i>Savannah</i>	<i>Augusta 5th St.</i>	<i>102.06</i>	<i>32</i>
<i>Savannah</i>	<i>Burton's Ferry</i>	<i>52.42</i>	<i>15</i>
<i>Savannah</i>	<i>Butler Creek</i>	<i>96.58</i>	<i>21</i>
<i>Savannah</i>	<i>Clyo</i>	<i>13.41</i>	<i>11</i>
<i>Stevens Creek</i>	<i>Modoc</i>	<i>197.34</i>	<i>18</i>
<i>Waccamaw</i>	<i>Conway</i>	<i>-0.65</i>	<i>7</i>
<i>Wateree</i>	<i>Camden</i>	<i>118.36</i>	<i>21</i>

**Table 4-1** *Gages used as National Weather Service Forecast Points.*  
*Source: National Weather Service and USGS*

*\* Zero datum is the elevation in mean sea level of "0" for the gage's stage.  
For example, zero datum for the Saluda River at Chappels is 362.89 feet above sea level. Flood stage of 14 is 14 feet above the gage's zero datum  
or  $362.89 + 14 = 376.89$  feet above sea level.*

#### **4.4.2 Warning dissemination**

Once the flood threat recognition system tells the emergency manager that a flood is coming, the next step is to notify the public and staff in other agencies and critical facilities that a flood is imminent. The earlier and the more accurate the warning, the greater the number of people who can take protection measures.

A flood warning may be disseminated in a variety of ways, including via NOAA Weather Radio, sirens, radio, television, cable TV, mobile public address systems, telephone trees, and even door-to-door contact. Multiple or redundant systems are most effective: if people do not hear one warning, they may still get the message from another part of the system.

**Implementation in South Carolina:** The NWS is depended on for warning of hurricanes, coastal storms, and flooding on the larger rivers. Its watch and warning systems are explained in the previous section.

The current NWS system uses the traditional approach where each gage has its own datum. Each gage's datum starts at "0," which is usually a few feet below the river bed (see Table 4-1). This has made it hard to relate gage readings and predictions to topographic or Flood Insurance Rate Maps based on mean sea level. However, they all can be converted to sea level. The NWS has a series of "E-19" forms which relate the stages to historical flood damage.

Many underpasses and low points are subject to flooding during heavy local rains. A simple staff gage that shows the depth of water would help to deter people who would otherwise attempt to drive through the flooded area.

Another weak point in the current practice of warning dissemination is the public's perception of the hazard. Many people do not realize that a flood watch or warning may apply to them. Some may assume that since they haven't been flooded before, they are safe. This can be a major problem in areas frequented by tourists, such as the resort communities on the coast.

### ***Recommendations:***

- ! The National Weather Service should publicize the “E-19” forms so local governments and the public can relate river stage forecasts to mean sea level and historical flooding.
- ! Local and state street and highway departments should install staff gages at underpasses and other sites subject to flooding.
- ! Public information programs should explain flood watches and warnings and appropriate safety and protection steps to take after they are issued.

### ***4.4.3 Flood response***

Once a flood threat is recognized, the first priority is to alert others through the flood warning system. The second priority is to respond with actions that can prevent or reduce damage or injury. Such actions (and the responding parties) could include:

- ! Activating the emergency operations center (emergency manager)
- ! Sandbagging certain areas (public works or township road department)
- ! Closing streets or bridges (police or sheriff's department)
- ! Shutting off power to threatened areas (utility company)
- ! Releasing children from school (school district)
- ! Ordering an evacuation (governor/mayor)
- ! Opening evacuation shelters (churches, schools, or the Red Cross)
- ! Monitoring water levels (engineer)
- ! Guarding sandbag walls and other protection measures (police)

A flood response or emergency action plan is the best way to ensure that all bases are covered and that the response activities are appropriate for the expected flood threat. It is developed in coordination with the agencies or offices that are given various responsibilities.

A flood response plan should include a flood stage forecast map. This map relates flood levels to topographic information to show where various floods will go. The plan should identify different activities for the different flood levels. Drills and exercises should be conducted between floods to ensure that key participants understand their duties. The result is a coordinated effort implemented by people who have experience working together so that available resources will be used most efficiently.

***Implementation in South Carolina:*** Most communities' emergency response plans do not address the known local flood hazard. With a little warning and a



flood stage forecast map that relates the predicted crests to affected areas, communities could prepare more site-specific and more useful response plans.

**Recommendation:** Communities should prepare flood response plans keyed to progressive local flood stages and available flood warning information.

#### ***4.4.4 Critical facilities protection***

The South Carolina Emergency Preparedness Division (EPD) defines a critical facility as a structure or system identified by a local government which performs an essential emergency function. Critical facilities fall into the categories of warning, health and medical, utilities, emergency operations and bridges on priority transportation or evacuation routes. County emergency managers periodically update their lists of critical facilities and report them to EPD.

Protecting critical facilities during a flood is a vital part of any emergency services effort. If a critical facility is flooded, workers and resources may be unnecessarily drawn away from protecting the rest of the community. If such a facility is prepared, it will be better able to support the community's flood response efforts.



**Figure 4-5** *A lack of emergency planning led to four deaths in this nursing home.*

Each critical facility should have its own flood response plan coordinated with the community's.

Most critical facilities have full-time professional managers or staff who are responsible for the facility during a disaster. These people often have their own emergency response plans. Many states require hospitals, nursing homes, and other public health facilities to develop such plans.

Local critical facility planning should also address other facilities that, if flooded, would create secondary disasters. These could include dams, hazardous materials storage, schools, and prisons.

**Implementation in South Carolina:** DHEC regulations require all health care facilities to have an emergency plan. The requirement was originally for fire safety

purposes, but has since grown and been interpreted to include tornadoes, hurricanes, flooding and hazardous materials.

Other critical facilities may or may not have emergency plans. For example, local school districts determine whether their schools should have one. Similarly, local emergency managers may or may not have coordinated with the critical facilities in their jurisdictions.

The Department of Social Services is the lead organization responsible for emergency shelters. It is reviewing its inventory and closing those that will not be useful during a flood. The Department of Education is doing similar work with schools, which often serve as shelters.

***Recommendation:***

- ! State regulatory agencies, such as DHEC, should identify the critical facilities under their jurisdiction that are affected by flooding and work with them to develop flood response plans that are coordinated with the local plans.
- ! Local emergency managers should identify the critical facilities under their jurisdiction that are subject to damage or isolation during a flood and work with them to develop flood response plans that are coordinated with the local plans.

***4.4.5 Health and safety maintenance***

Preventing dangers to health and safety is critical after a flood. The flood response plan should identify appropriate measures to take. These include:

- ! Patrolling evacuated areas to prevent looting
- ! Providing safe drinking water
- ! Vaccinating residents for tetanus and similar diseases
- ! Clearing streets
- ! Cleaning up debris and garbage
- ! Evaluating damaged buildings to determine if they can be reentered

The plan also should identify which agencies will be responsible for carrying out these measures. Normally, they are the police, sheriff, or public health authorities.

Many people are more interested in returning to and repairing their flooded properties than in taking health and safety precautions. A public information program to counter this tendency is an essential part of any flood response plan.

***Implementation in South Carolina:*** Lessons learned after Hurricane Hugo have improved local abilities to maintain public health and safety after all kinds of disasters. For example, new approaches needed to be developed for clean up procedures in flooded hog farms.

***Recommendation:*** Flood response plans should include updated health and safety maintenance measures based on the latest lessons learned.

#### ***4.4.6 Post-disaster recovery and mitigation***

After a disaster, communities should undertake activities that can prepare people and property for the next one. They are implemented during recovery to keep people from immediately going “back to normal” (i.e., the same way they were before the disaster). These measures include:

- ! Regulating reconstruction to ensure that it meets all code requirements, including the NFIP’s substantial damage regulations,
- ! Public information to advise residents about mitigation measures they can incorporate into their reconstruction work (e.g., using waterproof or fireproof materials, elevating utilities above flood level, and securing large items that will fall during ground shaking),
- ! Evaluating damaged public facilities to identify mitigation measures that can be included during repairs,
- ! Acquiring substantially or repeatedly damaged properties from willing sellers,
- ! Planning for long term mitigation activities, and
- ! Applying for post-disaster mitigation funds.

Requiring permits, making inspections and enforcing the substantial damage regulations can be very difficult on local, partially-trained and understaffed offices after a disaster. If not done right, not only does a community miss a tremendous opportunity to redevelop or clear out a hazardous area, it may be violating its obligations to the NFIP.

***Implementation in South Carolina:*** Experience after Hurricane Hugo showed that the State and few communities had prepared recovery/mitigation programs in place. It took months for local staffs to initiate mitigation planning.

State post-disaster activities devote more attention to health and safety maintenance and providing disaster assistance than to reconstruction requirements

and mitigation. There is no separate State recovery plan or structure to determine the best way to utilize or distribute post-disaster mitigation funds.

There was an Interagency Hazard Mitigation Team Report prepared by a Federal/State team after Hurricane Hugo. The Report proposed some long-term recommendations for the State. Several of these have been implemented. These include:

- ! The State's building code legislation
- ! Creation of the wind testing facility at Clemson University
- ! A comprehensive wildfire plan

There is no longer a requirement or process for Interagency Hazard Mitigation Team Reports. It has been replaced by a new process that sets mitigation strategies for the post-disaster period.

***Recommendations:***

- ! Communities should include post-disaster reconstruction regulation and mitigation planning procedures in their post-flood response planning.
- ! Preliminary damage assessments conducted immediately following a flood to evaluate conditions should be used to identify appropriate mitigation measures (including sites appropriate for acquisition and clearance).
- ! Both the local and State/Federal mitigation efforts should evaluate the warning and response activities that were implemented during the disaster.

## ***4.5. Structural projects***

Structural projects are used to prevent floodwaters from reaching properties. These measures are "structural" because they involve construction of man-made structures to control water flows. They can be grouped under six measures:

- |                              |                                 |
|------------------------------|---------------------------------|
| ! Reservoirs/impoundments    | ! Channel modifications         |
| ! Levees/floodwalls/seawalls | ! Channel and basin maintenance |
| ! Diversions                 | ! Dune and beach maintenance    |

Most structural projects can have the following shortcomings:

- ! They can be too expensive for one community or agency to afford.
- ! They disturb the land and disrupt natural flows, often destroying habitats.
- ! They require regular maintenance, which if neglected, can have disastrous consequences.

- ! They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
- ! They can create a false sense of security, as people protected by a project often believe that no flood can ever reach them.

#### ***4.5.1 Reservoirs/impoundments***

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can handle downstream. The lake created may provide recreational benefits. Wet or dry basins can serve multiple uses by doubling as parks or other open space uses.

Reservoirs are suitable for protecting existing development. They may be the only flood control measure that can protect development close to a watercourse.

Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store. Building a reservoir in flat areas and on large rivers may not be cost-effective because large areas of land have to be purchased.

In urban areas, some reservoirs are simply man-made holes dug to provide enough room to store floodwaters. In some areas, costs have been reduced by using abandoned quarries.

As with other structural projects, reservoirs:

- ! Are expensive
- ! Remove productive land from the tax base
- ! Require periodic maintenance
- ! May fail to prevent damage from floods that exceed their design levels
- ! May eliminate the natural and beneficial functions of the floodplain
- ! May create a flash flood hazard to properties downstream of the dam

Reservoirs should be implemented after a thorough watershed analysis that identifies the most effective and efficient location for one or more structures and to ensure that they will not increase a flooding problem elsewhere. Because they involve more than one community and are so expensive, they are typically implemented with the help of state or Federal agencies, such as the U.S. Army Corps of Engineers and the Natural Resources Conservation Service.

***Implementation in South Carolina:*** Reservoirs and detention basins have been built throughout the state. The largest examples are the Hartwell, Richard Russell, and Strom Thurmond lakes built by the Corps of Engineers on the Savannah River. These are also multi-purpose reservoirs that are managed for water supply, recreation and wildlife protection benefits but they also provide over 800,000 acre feet in flood control storage.

***Recommendations:***

- ! Designs for reservoirs built for water supply, recreation or other purpose should include flood protection measures. Flood pools and flood protection measures should be considered when existing reservoirs are rehabbed or retrofitted.
- ! Flood protection plans that consider reservoirs should clearly explain their full costs and shortcomings to the affected local officials and residents.
- ! The State's dam safety program should continue to review plans for new dams, monitor the condition of existing dams, and publicize the potential hazards to downstream residents.

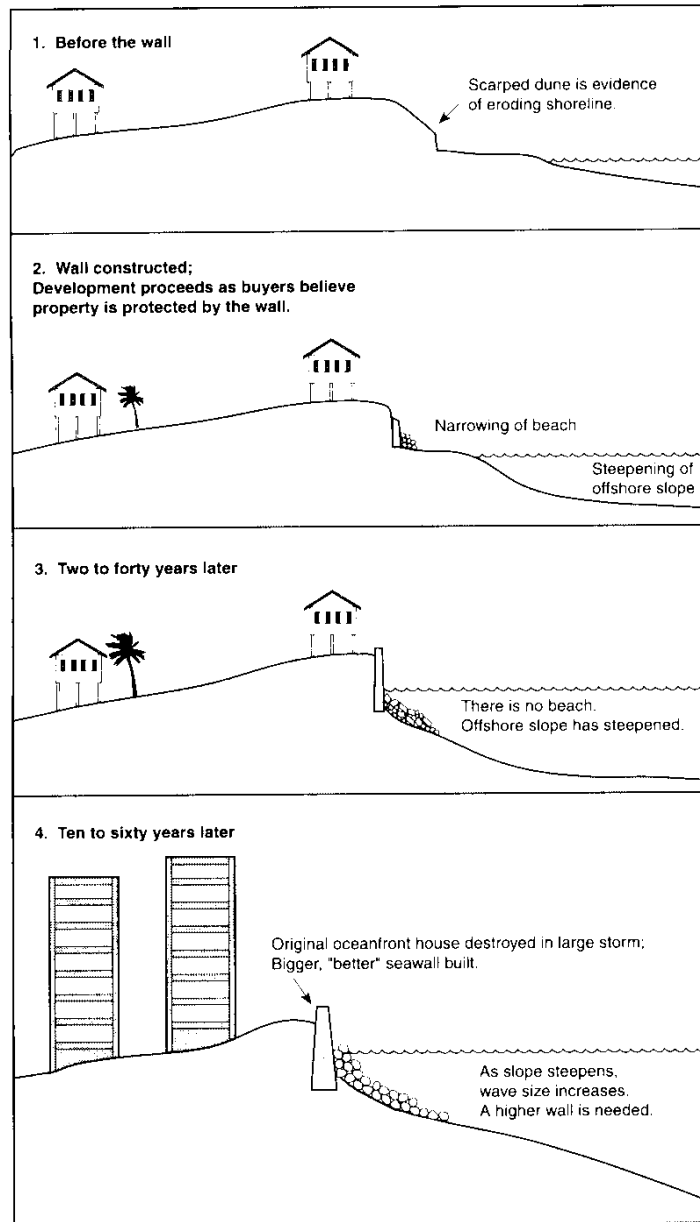
***4.5.2 Levees/floodwalls/seawalls***

Probably the best known structural flood control measure is a barrier of earth (*levee*) or steel or concrete (*floodwall*) erected between the watercourse and the property to be protected. Levees need considerable room to fit between the river and the area to be protected. If space is a constraint, more expensive floodwalls are used.

Levees and floodwalls should be set back out of the floodway so they will not push floodwater onto other properties. Their design also should compensate for the flood storage that they will displace and for access through or over the barrier.

*Seawalls, bulkheads and revetments* are built on the seashores and lakeshores. They can be made of timber, concrete, metal sheet piling or rocks (*rip rap*). Walls made of large sandbags (greater than 1,000 pounds each) are treated as seawalls because they usually become permanent and they have the same effect on flooding and sand movement.

Seawalls can have an adverse impact on the shore and on neighboring properties and the movement of sand. The natural forces that transport sand and replenish beaches are disrupted by the wall, often increasing shoreline erosion on adjacent properties.



**Figure 4-6 "The Saga of a seawall"**  
 -- *Living with the South Carolina Coast,*  
 Lennon, et. al., 1996

**Implementation in South Carolina:** There are some levees and a few floodwalls protecting urban areas on the State's rivers, but no major projects by the Corps of Engineers.

There are also some seawalls along the shore. However, regulations under the South Carolina Beach Front Management Act of 1988 have banned new seawalls and reconstruction of damaged seawalls because of their adverse affect on

neighboring properties and shorelines. Figure 4-7 shows one of the reasons for this ban.

***Recommendations:***

- ! Flood protection plans that consider levees or floodwalls should clearly explain their full costs and shortcomings to the affected local officials and residents.
- ! The prohibition of seawalls along the shore should be continued.

### ***4.5.3 Diversions***

A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over to the diversion channel or tunnel which carries the excess water to the receiving lake or river.

Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel is needed.

Care must be taken to ensure that the diversion does not cause a new flood problem or adversely affect adjacent property owners. Even the appearance of transferring the flood to someone else greatly complicates — and often halts — a diversion project. Diversion channels may be blocked by residents who don't understand, or don't agree with, their purpose.

***Implementation in South Carolina:*** The construction of the Pinopolis Dam on the Santee River had diverted flows into Charleston Harbor, increasing sedimentation. The Corps of Engineers diverted the higher flows above the dam back to the Santee River. This project is considered a navigation improvement project for the harbor and has no official flood control benefits. Otherwise, there are no known diversions on any of the state's major rivers and streams.

***Recommendation:*** Flood protection plans that consider diversions should clearly explain their full costs and shortcomings to the affected local officials and residents.



#### 4.5.4 Channel and drainage modifications

By increasing the conveyance of a stream channel or drainage ditch, more water is carried away. While this benefits those immediately affected, often, the extra water will cause increased flooding downstream.

*Channel modifications* include making a channel wider, deeper, smoother or straighter. Some smaller channels can be lined with concrete or even put in underground pipes. Modifications that result in faster moving water may also increase bank erosion which can lead to undercut properties and downstream sedimentation.

*Dredging* is one form of channel modification. Dredging is often cost prohibitive because the dredged material must be disposed of somewhere and the stream will usually fill back in with sediment in a few years. Dredging is usually undertaken on larger rivers only to maintain a navigation channel.

*Drainage modifications* include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainageways may be safer or more attractive. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer projects usually carry the runoff from smaller, more frequent storms.

*Storm sewer improvements* include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding.



Kingstree Branch Before



Kingstree Branch After

**Figure 4-7** A Corps of Engineers channel modification project in Williamsburg County

Flap gates and valves can prevent backflow when the receiving stream or lake is flooding. Debris can sometimes get caught, preventing them from closing and making them useless. This can be prevented with proper monitoring and maintenance and use of designs that are less prone to obstructions.

***Implementation in South Carolina:*** Channel modifications have been the most commonly used structural flood control projects in the state. They are most efficient on smaller streams and have been the main approach used by the Corps of Engineers' Small Projects authorities, especially in the low country where the terrain does not lend itself to reservoirs.

There have been concerns raised recently about these types of projects. They tend to transfer a problem downstream and they have adverse impacts on the environment. As a result, it is reportedly harder to get a permit for channel work approved by agencies such as the U.S. Fish and Wildlife Service.

***Recommendation:*** Flood protection plans that consider channel modification should clearly explain their full costs and shortcomings to the affected local officials and residents.

#### ***4.5.5 Channel and basin maintenance***

Channel and detention basin maintenance is an ongoing program to clean out blockages caused by overgrowth or debris. This work is usually done by a public works or drainage district crew. These activities normally do not affect the shape of the channel or basin, but they do affect how well they can perform.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Individual actions can cause big and small problems.

Therefore, a drainage system maintenance program should include regulations that prevent dumping in or altering watercourses or storage basins. Regrading and filling activities in areas not mapped as floodplains should be regulated similar to the NFIP requirements to avoid adverse impacts on neighbors. There should be public information materials that explain the reasons for the rules as well as the penalties. Regular inspections to catch violations should be scheduled.

***Implementation in South Carolina:*** It is generally understood that State law requires property owners to maintain their portions of a waterway, but this is not generally enforced. The law prohibits communities from entering private property

without permission to clear an obstruction, even if it could cause flood damage to others. There is no common practice of requiring developers to set aside easements for drainage or maintenance purposes.

Most communities do not have formal drainage maintenance programs. The Community Rating System has encouraged at least 17 CRS communities to organize and write down what were likely formerly ad hoc maintenance practices. Ten of them have ordinances that prohibit dumping in waterways.

Section 48-14-120 of the state statutes authorizes local governments to establish a stormwater utility. A utility can fund maintenance programs through collection of fees based on the amount of runoff from a property. Mount Pleasant has followed this approach and has funds for its maintenance needs.

State law does allow state maintenance of state owned and navigable rivers. Debris has been seen as a major source of bridge failure, so the Department of Transportation has used this authority to keep bridges and culverts clear of debris.

### ***Recommendations:***

- ! Local governments should be given clear statutory authority to enter all properties, public and private, within or outside their corporate limits, to remove obstructions or debris that can increase the flood hazard to other properties.
- ! Communities should develop formal drainage system maintenance programs and investigate the stormwater utility approach to obtain a dedicated source of funding.

### ***4.5.6 Dune and beach management***

Sand dunes and wide beaches protect inland properties by providing a barrier and breakwater for coastal storms.

Maintenance programs can preserve these features and, in some cases, increase their size or effectiveness.

*Maintenance* of dunes and beaches include protection from disruption by traffic or construction through regulations against foot and vehicle traffic and building codes. Stairs and boardwalks over dunes protect the sand and the plants that help



***Figure 4-8 Dune preservation is vital to protect inland properties.***

keep the sand in place. Other maintenance projects include planting vegetation and installing fences that catch and hold sand.

*Beach nourishment* differs from beach maintenance in that sand is excavated from one site and placed to preserve a retreating beach. The effectiveness of nourishment programs depend on the type of sand imported, the slope of the natural beach, cross shore currents, and the frequency of storms. Therefore, careful professional design is essential.

*Groins* are structures built perpendicular to the shore of timber, concrete, metal sheet piling or rock. When properly designed, they catch the sediment that is being carried by the cross shore currents and replenish the beach on one side of the groin. Unfortunately, the net sand transport on the other side of the groin is reduced. This interruption of longshore currents builds the beach in one section, but erodes another.

***Implementation in South Carolina:*** There are no state requirements for routine dune or beach maintenance, so each community has been free to implement whatever practices it wants. However, if a community wants state funding for beach projects, it must have a beachfront management plan approved by the Office of Ocean and Coastal Resource Management in the Department of Health and Environmental Control. Among other things, a beachfront management plan addresses beach access, zoning, erosion control alternatives, protection of habitats, regulation of traffic, and public education and awareness.

To date, 13 communities have an approved plan. Some without plans have had requests for funding denied. One reason communities do not want to adopt a beachfront management plan is because of the requirement to allow public access to the beaches.

The Corps of Engineers reports that about 30% of the State's 187 miles of shoreline are "critically eroded," especially in resort areas. Beach nourishment projects have been used to rebuild eroded beaches, generally every 5 - 7 years.

One of the better known recent examples has been the restoration of 5.34 miles of Folly Beach's shoreline. The value of the properties at risk and the recreation and tourism benefits justified this \$12 million project.

As with seawalls, construction of new groins is not allowed under the South Carolina Beach Front Management Act regulations.

There are several ways beach nourishment is funded. Myrtle Beach and Folly Beach have received support from the Corps of Engineers on a 65 Federal/35 local cost share. Outside funding is vital as the Myrtle Beach project cost \$52 million.

Hilton Head Island used a state appropriation in 1990, but now has a local accommodation tax which fully funded the 1997 nourishment project. Other communities along the coast use state appropriations managed by the Office of Ocean and Coastal Resources Management.

***Recommendations:***

- ! Communities should adopt beachfront management plans and implement formal dune and beach maintenance programs.
- ! Beach nourishment plans should clearly explain their full costs and shortcomings to the affected local officials and residents. Encouraging more coastal development should not be one of the reasons for a beach nourishment project.
- ! The prohibition of groins along the shore should be continued.

## ***4.6. Public information***

Public information activities advise property owners, potential property owners and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of floodplains. They are usually implemented by a public information office.

Public information measures can include:

- |                          |                           |
|--------------------------|---------------------------|
| ! Flood hazard maps      | ! Library                 |
| ! Map information        | ! Technical assistance    |
| ! Outreach projects      | ! Environmental education |
| ! Real estate disclosure |                           |

### ***4.6.1 Flood Hazard Maps***

Maps are needed to support all of the hazard mitigation strategies. They delineate the areas subject to the preventive regulations and natural resource programs, they provide data needed to design property protection and structural projects, they identify who is affected by a flood warning, and they convey basic information to the public.

The most commonly used maps are FEMA's Flood Insurance Rate Maps (FIRMs) which predict the area affected by a 100-year or base flood. They are used in local regulatory programs, by insurance agents to set flood insurance rates, and by

lending institutions to determine if flood insurance is required as a condition of a loan.

There are four major problems with FIRMs. First, they do not show all flood problems. The FEMA mapping standard is to show floodplains along streams that drain more than one square mile in urban areas and 10 square miles in rural areas. Local drainage problems that cause flood damage may not appear on a FEMA floodplain map.

Second, FIRMs are not always accurate. Accurate mapping requires more funding for more detailed mapping. FEMA is working on this with its Map Modernization Program, which is exploring various ways to reduce the cost of mapping and utilize new technologies. The recent county-wide FIRMs provide a more useful tool in metropolitan areas, especially where corporate limits are changing.

The third problem with FIRMs is they may not always reflect the latest flood hazard information. They can be updated. People who want to avoid the regulatory or insurance purchase requirements submit new data to FEMA, such as more accurate ground elevation information or the effects of new structural projects. Today, processing these requests is almost as big a job as preparing new maps. It can be a very trying and expensive process for property owners who want their FIRMs to more accurately reflect local conditions.

A fourth concern is that paper FIRMs are not geographically referenced to longitude and latitude. They may or may not reflect current ground conditions. As a result, it is hard to combine the FIRM's floodplain with other layers in a geographic information system (GIS) that are used for land use or emergency planning. Streets, channels and other places may or may not jive with the FIRM's locations for the same features.

***Implementation in South Carolina:*** There are FIRMs published for over 200 cities and counties in the state. Communities are required to maintain them so they reflect all map amendments and revisions. They are also encouraged to submit new data when available and cost share on remapping to help keep them up to date with new developments and hydrologic and topographic changes.

More accurate and "user friendly" maps are sometimes available. These may be digital maps (which make for easier revision and use in geographic information systems) or on aerial photo base maps. A digital series has been developed by the Office of Ocean and Coastal Resource Management for the coastal areas.

Ten of the 46 counties now have FIRMs in the digital "Q3" format. New FIRMs are done in county-wide Digital FIRM formats that are compatible with the geographic information systems that more and more communities are using. There

are new GIS-products for the State, including a 1998 *South Carolina Atlas of Environmental Risks and Hazards* on a CD-ROM (an example is Figure 2-7).

The Community Rating System provides credit for providing new floodplain data and mapping for local regulations (Activity 410) and for keeping maps and map data updated, such as with a geographic system (Activity 440). However, no communities are receiving credit for the former and only 3 have digital systems that are credited under the latter.

***Recommendations:***

- ! Communities should use the latest techniques to keep their FIRMs and other flood hazard maps up to date.
- ! Communities should seek new sources, such as developers, to help fund detailed flood hazard mapping and remapping.

#### ***4.6.2 Map information***

There are many benefits to providing map information to the public. Residents and businesses who are aware of the potential flood hazard can take steps to avoid problems and/or reduce their existing exposure to flooding. Real estate agents and house hunters can find out if a property is floodprone and whether flood insurance may be required.

Communities are the best source of map information because they can often supplement what is shown on the FIRM with maps that complement and clarify the FIRM and information on additional hazards, flooding outside mapped areas, flood insurance and property protection measures.

Flood maps have a wealth of information about past and potential flood hazards. However, they can be hard to obtain and many people have trouble reading maps. Therefore, communities that provide map or FIRM information provide a valuable public information service.

***Implementation in South Carolina:*** Many communities assist their residents and inquirers with information from their FIRMs. All but one of the CRS communities have formal map information programs. Their services are publicized to encourage their use.

***Recommendation:*** Communities should use the latest techniques to make map information available to inquirers. These could include web sites and easy to use software.

#### ***4.6.3 Outreach projects***

Outreach projects are a proactive approach to public information. They reach out to people and give them information, even when they do not ask for it. They can cover a variety of topics, such as the flood hazard, flood insurance, ways to prevent or reduce flood damage, flood warning procedures, and local regulations. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties.

There are many types of outreach projects. They can include:

- ! Mass mailings or newsletters to all residents
- ! Notices directed to floodplain residents
- ! Displays in public buildings, shopping malls, etc.
- ! Displays or special sales in home improvement stores
- ! Signs and “hurricane town fairs” that reach beach users
- ! Newspaper articles and special sections
- ! Radio and TV news releases and interview shows
- ! A floodproofing video for cable TV programs or to loan to organizations
- ! A detailed property owner handbook tailored for local conditions
- ! Presentations at meetings of neighborhood groups
- ! Internet web sites

Research has proven that outreach projects work. Not only do they educate residents, but local decisions makers become more aware of the hazards and ways to reduce their impact.

However, awareness of the hazard is not enough; people need to be told what they can do about it, so projects should include information on property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

***Implementation in South Carolina:*** Many communities conduct a variety of outreach projects. Twenty-three CRS communities receive credit for their projects. The two communities that don’t do outreach projects are counties. It is more expensive and difficult to conduct mailings, newsletters, and similar types of projects in counties.

***Recommendation:*** Communities should prepare well thought out public information programs that inform their residents, businesses, tourists, and others of the hazards and ways to protect themselves. Such efforts should maximize the use of existing public and private information programs.

#### **4.6.4 Real estate disclosure**

Many times after a flood, people say they would have taken steps to protect themselves if only they had known they had purchased a floodprone property. Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by a building that the property is in a floodplain as shown on the Flood Insurance Rate Map.

Because this requirement has to be met only ten days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

State laws and local practices by local real estate boards can overcome this deficiency and advise newcomers about the hazard earlier. They may also require disclosure of past flooding or sewer problems, regardless of whether the property is in a mapped floodplain.

**Implementation in South Carolina:** There are no state laws requiring disclosure of whether a property is in a floodplain or subject to coastal erosion. Sellers are required to disclose if there has been a history of flooding. Twenty-two CRS communities are receiving credit for some disclosure requirements, such as showing the floodplain on new subdivision plats.

The Department of Natural Resources has published a brochure, "The National Flood Insurance Program and the Real Estate Professional," which explains why real estate agents should determine and disclose whether a property is in a mapped floodplain. It notes that such disclosure will help the buyer get a mortgage, understand local regulations, and be aware of restrictions on disaster assistance and the cost of flood insurance premiums.

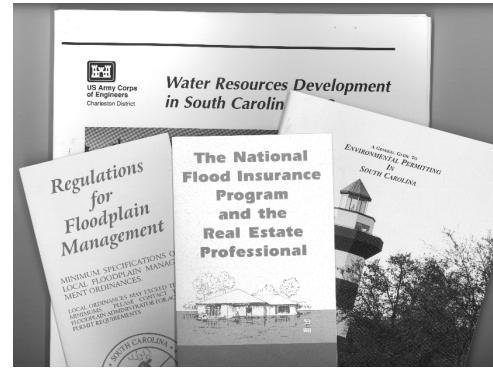
Ten CRS communities are receiving credit for voluntary real estate agency disclosure of flood hazards. Nine of those ten are on the coast, where the hazard is greater and there is a higher level of public knowledge about it.

**Recommendation:** Communities should use all methods available, including subdivision plat requirements, plats of survey, tax maps and cooperative efforts with real estate agencies, to advise potential property purchasers about a property's known flood hazard.

#### **4.6.5 Library**

The community library is an obvious place for residents to seek information on flooding, flood protection, and protecting natural resources. Libraries are usually the first place people turn to when they want to research a topic.

Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the municipal or county government.



**Figure 4-9** South Carolina flood references

**Implementation in South Carolina:** Many libraries have some publications on flooding, but there is no state program to provide recent or pertinent publications. All but two of the CRS communities are receiving credit for having appropriate flood protection references in their local libraries.

**Recommendation:** Local libraries should be provided with the latest list of flood protection references, government publications, Internet web sites, and instructions on how to order free documents (e.g., via the FEMA Fax line).

#### **4.6.6 Technical assistance**

Property owners usually implement their own property protection measures. However, measures to encourage and assist owners can be implemented at the community level.

Technical assistance can be provided in one-on-one sessions with property owners. Community officials can provide advice and information on matters such as identifying flood hazards at the site, correcting local drainage problems, floodproofing, dealing with contractors, and funding.

One effective technique is called a *flood audit*. A knowledgeable person visits a floodprone site, locates past and potential (e.g., the 100-year) flood depths on the property, and discusses alternative protection measures with the owner. The owner is given a written report with recommendations and a picture of the property showing flood depths.

**Implementation in South Carolina:** As with other locally implemented activities, there is no measure of how many communities provide technical assistance. Fifteen CRS communities are credited with providing this service. The Natural Resource Conservation Service and the county soil and water conservation districts can help local technical assistance programs.

**Recommendation:** Communities should offer technical assistance to floodprone residents and businesses. Such efforts should maximize the use of existing public and private assistance programs, such as the Natural Resource Conservation Service program and home improvement stores that help the “handyman.”

#### ***4.6.7 Environmental education***

A community’s most important asset is its children, the future generations who will inherit the resources, infrastructure and development left to them. They will be facing the same natural forces that cause periodic flooding. The watersheds and floodplains will be theirs to farm, build on and care for.

Environmental education programs can teach children about flooding, the forces that cause it, the factors that cause flood problems, and the significance of protecting the natural and beneficial functions of watersheds and floodplains. These programs can be undertaken by schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts, Campfire Girls and summer camps. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river or on the beach.

Education programs do not have to be limited to children. Adults, especially decision makers, elected officials, and those active in land development, benefit from a greater knowledge about flood problems, their causes and solutions.

**Implementation in South Carolina:** There are many potential sources of environmental education programs, but no measures of how widespread they are.

**Recommendation:** Communities and State and Federal agencies should inventory current environmental education programs and encourage appropriate ones to include information on flood hazards and flood protection.

## ***5. Agencies and Programs***

This chapter reviews those State and Federal agencies and private organizations that can have a role in flood hazard mitigation. At the end of this chapter is a matrix that matches these agencies with the mitigation strategies that they are involved with.

### ***5.1. State Agencies***

#### ***5.1.1. Governor's Office, Budget and Control Board***

**General Services - State Building and Property Services** The State Building and Property Services provides for the leasing of State buildings and conducts the contracts for non-State facilities which are used by the State. There are 5,400 State-owned facilities which are owned and/or administered by various agencies.

*Flood hazard mitigation activities:* There is a project underway to determine which State buildings are in a floodplain.

Contact: Robert McClam  
McClam@gs1.state.sc.us  
Assistant Director  
1201 Main St., Suite 410  
Columbia, SC 29201  
(803) 737-0790  
(803) 737-0689 fax

**Office of Insurance Services:** The State of South Carolina maintains a self-insurance program. The Office of Insurance Services, Insurance Reserve Fund, issues insurance policies, charges premiums, and pays claims from the accumulated premiums. All State agencies participate in the program. Participation in the program is optional for local governments.

Each insured building is scheduled with an insured value. The contents of the building are also scheduled with an insured value. Participating agencies are encouraged to purchase amounts of insurance equal to replacement cost.

*Flood Hazard Mitigation Activities:* The Fund currently provides insurance on real property valued at \$12 billion. Coverage is provided on an "all risk" form including flood. The flood coverage provided by the Fund is similar to the National Flood Insurance Program's coverage.

Contact: John Trussell  
*Jtrussell@ois.state.sc.us*  
State Budget and Control Board  
Office of Insurance Reserve Fund  
1201 Main Street, Suite 500  
Columbia, SC 29201  
(803) 737-0020  
(803) 737-0042 fax

**Internal Operation - Hurricane Hugo Public Assistance Program** This program was created in 1989 for the purpose of recovery from Hurricane Hugo. The program is in charge of handling assistance to State and local governments and certain private non-profit agencies recovering from Hugo. Public Assistance for disasters declared since Hurricane Hugo is handled by the Emergency Preparedness Division.

This program funds the repairs or replacements of publicly owned eligible facilities. Improvements can be incorporated into the repair or replacement if it mitigates future damage, is technically feasible and cost-effective.

*Flood hazard mitigation activities:* This program also provides financial assistance in developing a funding strategy for an acquisition, relocation, or other appropriate mitigation measure in the form of the Hazard Mitigation Grant Program (HMGP) for the Hurricane Hugo disaster.

Contacts: Franz Coetzee  
Fred Helms  
P.O. Box 11509  
Columbia, SC 29201  
(803) 253-7545 (Franz Coetzee)  
(803) 253-7546 (Fred Helms)

**Office of Materials Management - State Engineer's Office** The State Engineer is designated as the Floodplain Administrator for the State of South Carolina, although the day-to-day management of the State's floodplains fall within the Department of Natural Resources. The State Engineer is also the Chair of the Variance Committee for all State construction.

*Flood hazard mitigation activities:* The State Engineer is in the position of approving State construction in the floodplain.

Contact: Mike Thomas  
*mthomas@gs1.state.sc.us*  
1201 Main Street, Suite 600  
Columbia, SC 29201  
(803) 737-0768  
(803) 737-3809 fax

**State Geodetic Survey** This office is responsible for mapping and surveying the State. It sets permanent survey markers and has helped counties develop geographic information systems (GIS).

*Flood hazard mitigation activities:* Accurate mapping and elevation reference markers are vital to regulating new construction in floodplains.

Contact: Lew Lapine  
*Llapine@scgs.state.sc.us*  
Chief, State Geodetic Survey  
5 Geology Road  
Columbia, SC 29212  
(803) 896-7701  
(803) 896-7695 fax

### ***5.1.2. Office of the Adjutant General***

**Emergency Preparedness Division** This Division is the Governor's designated contact in the event of a disaster. It is the State's liaison between community officials and the Federal government for emergencies and disasters.

This Division is responsible for publishing the State's 404 & 409 plans as required for presidentially declared disaster assistance. Other plans that can be found are the South Carolina Hurricane Plan, the South Carolina Emergency Operations Plan, and the South Carolina Emergency Recovery Plan.

*Hazard mitigation activities:* One of the programs within the Emergency Preparedness Division is the Hazard Mitigation Grant Program. This program allows communities to apply for post-disaster FEMA grants that are to be used for mitigation purposes within the community. These mitigation projects can be short or long term solutions to prevent repeated damage to the community.

Contacts: Stan McKinney, Director  
*smmckinn@strider.epd.state.sc.us*  
John Knight, Chief, Mitigation and Risk Assessment  
*jknight@strider.epd.state.sc.us*  
South Carolina Emergency Preparedness Division

1429 Senate Street  
Columbia, SC 29201  
(803) 734-8020  
(803) 734-8062 fax

Web site:  
[www.state.sc.us/epd](http://www.state.sc.us/epd)

### ***5.1.3. Department of Archives and History***

**State Historic Preservation Office** The State Historic Preservation Office (SHPO) helps the State's citizens preserve their historic heritage. It was established to implement the goals of the National Historic Preservation Act of 1966, which extended Federal support to State and local preservation efforts. SHPO is the office that

- ! Coordinates the statewide survey;
- ! Nominates significant historic and prehistoric resources to the National Register of Historic Places;
- ! Provides financial help for preservation projects;
- ! Encourages the rehabilitation of historic buildings through State and Federal tax incentive programs;
- ! Helps communities develop local historic preservation program suited to their needs; and
- ! Provides information, education and training.

*Flood hazard mitigation activities:* This office must approve the modification (including retrofitting for flood protection) of historical properties.

Contact: Andrew Chandler  
8301 Park Lane Road  
Columbia, SC 29223  
(803) 896-6179  
(803) 896-6167 fax

### ***5.1.4. Department of Commerce***

**Community Development Block Grant Program** The Community Development Block Grant (CDBG) Program is designed to provide assistance to units of general local government in improving economic opportunities and meeting community revitalization needs, particularly for persons of low and moderate income.

There are two types of local governments eligible to apply for CDBG financial assistance. Entitlement communities receive CDBG funds directly from the U. S. Department of Housing and Urban Development. They set their own priorities and determine eligible activities. They include:

- |                |   |
|----------------|---|
| ! Aiken        | ! Rock Hill   |
| ! Anderson     | ! Sumter  |
| ! Charleston   | ! Charleston County and all municipalities except Lincolnvile |
| ! Columbia     |   |
| ! Florence     | ! Greenville County and all municipalities                    |
| ! Greenville   | ! Spartanburg County, Spartanburg and                         |
| ! Myrtle Beach | Woodruff  |

All other communities can apply to the Department of Commerce under the Small Cities CDBG Program. The Small Cities Program gives maximum priority to activities which will benefit low and moderate income persons. Grants are available for a minimum of \$50,000 for public facilities.

Projects are funded under one of six programs:

- ! Community Investment Program
- ! Economic Development Program
- ! Regional Planning Assistance Program
- ! Local Planning Assistance Program
- ! Section 108 Loan Guarantee Program
- ! Jobs-Economic Development Authority, Revolving Loan Fund

*Flood hazard mitigation activities:* The CDBG can be used to fund local mitigation projects. Often special funding is made available through the CDBG following a disaster. Building elevation projects were funded after Hurricane Hugo.

Contact: Bonnie Ammons  
*bammons@commerce.state.sc.us*  
 1122 Lady Street, Suite 700  
 Columbia, SC 29201  
 (803) 734-1399  
 (803) 734-0385 fax

### ***5.1.5. Department of Education***

**Office of District Facilities Management** The Office of District Facilities Management oversees school construction projects. To do this, the Office:

- ! Reviews and approves applications for State funds for construction and improvement of school buildings
- ! Inspects and approves new school sites
- ! Reviews plans and specifications
- ! Inspects construction and issues occupancy certificates

- ! Approves requests to dispose of school property
- ! Coordinates with other State agencies, such as the State Fire Marshal and DHEC

*Flood hazard mitigation activities:* This office regulates school construction projects in the floodplain, provides technical assistance in evaluating schools sites and facility conditions, and funds school construction projects.

Contact: John Kent  
 jkent@sde.state.sc.us  
 1429 Senate Street  
 Columbia, SC 29201  
 (803) 734-8824  
 (803) 734-6225 fax

#### ***5.1.6. Department of Health & Environmental Control (DHEC)***

**Office of Environmental Quality Control** This office administers a variety of regulatory or licensing programs.

*Flood hazard mitigation activities:* The Office regulates the following activities which are directly related to floodplain development and, therefore, flood hazard mitigation:

- ! Dams, reservoirs and diversion of water to another basin (interbasin transfers)
- ! Dredging, filling or construction in navigable waters
- ! Environmental laboratories
- ! Hazardous, infectious and radioactive waste facilities
- ! Mining and reclamation
- ! Oil and gas drilling
- ! Public swimming facilities
- ! Public drinking water systems
- ! Solid waste landfills and handling facilities
- ! Stormwater runoff
- ! Wastewater treatment plants
- ! Activities in wetlands and waterways that require Federal permits and licenses

**Construction and Stormwater Management** DHEC has two programs that regulate stormwater runoff from new development. The NPDES (National Pollution Discharge Elimination System) program is implemented pursuant to rules set by the U.S. Environmental Protection Agency. It covers a variety of

facilities “associated with industrial activity” and any construction that disturbs five or more acres. Agricultural operations are exempt.

Permittees must have a pollution prevention plan that controls stormwater discharges. The plan must use best management practices to minimize stormwater exposure to pollutants and provide for erosion and sediment control. Permittees must perform self-inspections periodically.

The other program is implemented pursuant to state law, the Stormwater Management and Sediment Reduction Act. These rules govern any construction project that disturbs two or more acres. The permittee must retain 80% of the sediment on the construction site or ensure that the discharge meets certain standards. The Department can delegate this regulatory authority to counties.

The Stormwater Management and Sediment Reduction Act rules require that the post-development runoff peak flows for the 2- and 10-year storms not exceed pre-development peak flows. This helps keep the downstream drainageways from being overloaded during small storms, but does not have much effect on flood flows from larger storms.

Because the Stormwater Management and Sediment Reduction Act affects smaller properties, it has become the basic stormwater rule for construction projects regulated by DHEC. It is likely that USEPA will revise the NPDES rules to govern projects as small as one acre. In that case, DHEC may defer to the NPDES water quality standards and not require restrictions on the quantity of runoff from new developments.

Contact: Rick Nuzum  
*nuzumjr@columb32.dhec.state.sc.us*  
Dept of Health and Environmental Control  
2600 Bull Street, Room 4581  
Columbia, SC 29201  
(803) 898-4034  
(803)898-4095 fax

**Dam and Reservoir Safety** Any dam which is 25 feet or more in height or which impounds a volume of fluid equal to or greater than 50 acre feet is a State-regulated dam. Additionally, any dam which is a direct threat to life (interpreted as one which has a house or mobile home directly below it in such a location that life would be threatened by a failure) is regulated, regardless of the size of the dam.

The South Carolina Dams and Reservoirs Safety Act also provides for a system of inspections and checks for State regulated dams, to insure they are being properly maintained. Excluded from DHEC regulation are all dams that are regulated by

the Federal government, all dams on Federal property, and all dams crossed by a public road if the road is the only property subject to damage.

*Flood hazard mitigation activities:* There are more than 50,000 impoundments in the State, with 2,240 of them subject to DHEC regulations:

- ! 147 high hazard dams: those dams whose failure would probably cause loss of life or a great deal of property damage. DHEC inspects these dams annually.
- ! 457 significant hazard dams: those dams whose failure would not be expected to cause loss of life but would cause some property damage. DHEC inspects these dams on a 3-year cycle.
- ! 1,636 low hazard dams: those dams whose failure would cause minimum property damage. These dams are not inspected by DHEC, but on a 3-year cycle are checked to insure there is no new development below them that would cause them to be moved to a higher classification.

Contact: George Ballentine  
ballengd@columb32.dhec.state.sc.us  
Dept of Health and Environmental Control  
2600 Bull St., Suite 4571  
Columbia, SC 29201  
(803) 898-3917  
(803) 898-4095 fax

**Office of Ocean and Coastal Resources Management (OCRM)** *Flood hazard mitigation activities:* The Coastal Zone Management Program:

- ! Protects marine resources from declining water quality
- ! Oversees wetland filling
- ! Regulates commercial and residential construction, including docks and piers
- ! Establishes construction set backs from the ocean.

The Office of Ocean and Coastal Resources Management (OCRM) oversees activities in the eight coastal counties (Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, Jasper), with particular interest in “critical areas” such as tidelands, coastal waters, beaches, and dunes. The program oversees activities through direct permitting and by reviewing permits issued by other agencies.

OCRM works with:

- ! ACE Basin National Estuarine Research Reserve
- ! North Inlet-Winyah Bay National Estuarine Research Reserve
- ! 504,000 acres of coastal marshes

Contact: Steve Snyder, Director  
*Snyderhs@chastn86.dhec.state.sc.us*  
 Coastal Zone Management Division  
 1362 McMillan Ave  
 Suite 400  
 Charleston, SC 29405  
 (843) 744-5838, ext. 129  
 (843) 744-5847

**Mining and Solid Waste Permitting** The Division of Mining and Solid Waste Permitting, within DHEC's Bureau of Land Use and Waste Management, is responsible for the permitting, compliance and enforcement of all mining activities and for the permitting of all solid waste management and disposal facilities located within the State. Through the mine permitting process, the program ensures that all lands and waters, including floodplains, receive the greatest practical degree of protection and restoration from the effects of mining.

The solid waste permitting rules require operators of landfills located in 100-year floodplains to demonstrate that the landfill will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in the washout of solid waste that would pose a hazard to human health or the environment.

*Flood hazard mitigation activities:* The staff evaluates all permit applications for compliance with State and Federal regulations, environmental impacts and public hazards.

Contact: Art Braswell  
*braswead@columb34.dhec.state.sc.us*  
 Bureau of Land and Waste Management  
 2600 Bull Street  
 Columbia, SC 29201  
 (803) 896-4263  
 (803) 896-4001 fax

**Division of Health Facilities Construction, Bureau of Health Facilities and Services Development** Although this program reviews plan designs for new and renovated health facilities within the State, floodplain management issues are not considered. This program, however, does require written evacuation plans for all facilities in the coastal areas. The division's policy is to let the local community handle floodplain management regulations.

Contact: William R. Lafferty, P.E., Director  
2600 Bull Street  
Columbia, SC 29201  
(803) 737-7213  
(803) 737-7212 fax

#### ***5.1.7. Department of Insurance***

This agency licenses and reviews the insurance industry in the State. It regulates \$6 billion in annual premiums to insurance companies and collects \$130 million in premium taxes.

Among other things, these premium taxes help fund the Advisory Committee to the Department of Labor, Licensing & Regulations' Building Codes Council. The Advisory Committee promotes implementation of building codes and loss mitigation.

*Flood hazard mitigation activities:* The Advisory Committee administers a Loss Mitigation Grant Program. The Program has up to \$100,000 each year to fund training, loss mitigation or other code related activities. The funds have helped communities adopt and implement their first building codes and have covered training expenses for code enforcement officers not paid under other programs.

Contact: Dean Kruger  
*Dkruger@doi.state.sc.us*  
Director of Property & Casualty Loss  
P.O. Box 100105  
1612 Marion Street  
Columbia, SC 29202  
(803) 737-5774

#### ***5.1.8. Department of Labor, Licensing & Regulations***

**Office of Real Estate and Building Code Professionals** This is the lead agency for the recently created Building Codes Council. In 1997, Senate Bill 236 required all municipalities and counties to establish permitting and enforcement codes and established the South Carolina Building Codes Council.

The purpose of the Council is to provide public policies pertaining to maintenance of a reasonable standard for construction in the State. Its duties include:

- ! Determining how much a community may vary from the State codes in

- setting construction standards,
- ! Monitoring the adoption of building codes by municipalities and counties,
- ! Certifying building code enforcement officers,
- ! Administering training and continuing education for code enforcement officers, and
- ! Licensing builders, manufactured home installers and home inspectors.

*Flood hazard mitigation activities:* The establishment and review of building code standards are vital to protecting new buildings from damage by floods and other hazards. The certification, licensing and training programs help assure knowledgeable and competent people are in charge of new construction.

Contact: Bob Selman  
 selmanr@zip.llr.sc.edu  
 P.O. Box 11847  
 Columbia, SC 29211-1847  
 (803) 896-4400  
 (803) 896-4404 fax

**Manufactured Housing Board** The Manufactured Housing Board sets regulations for the placement of manufactured homes within the State.

For elevated manufactured homes the regulations require: if the manufactured home is installed on a basement or split entry type foundation over a habitable lower-level area, or when more than one-fourth of the area of a manufactured home is installed so that the bottom of the main frame members are more than 3 feet above ground level, the foundation system shall be designed by a registered professional engineer or architect and the installation shall be approved by the local authority having jurisdiction.

*Flood hazard mitigation activities:* This office regulates the installation of mobile homes in flood hazard areas.

Contact: Gary Wiggins  
 wigginsg@zip.llr.sc.edu  
 P.O. Box 11329  
 Columbia, SC 29211-1329  
 (803) 896-4682  
 (803) 896-6038 fax

**Office of State Fire Marshal** The Division of Fire and Life Safety serves as the fire safety focal point for South Carolina, maintaining a statewide delivery system for fire prevention, protection, and training services. The Division provides leadership, guidance, and services needed by the fire service to carry out its

responsibilities at the local level.

The State Fire Marshal is charged with the responsibility for requiring compliance with national and State-adopted fire safety codes and standards. The Fire Academy is charged with the operation of a training facility to upgrade the State's fire service personnel.

The State Fire Marshal has regulatory responsibility to ensure compliance with State fire safety regulations. This is accomplished through inspection activities by deputy State fire marshals in the field and code consultation and plans review services provided by the Engineering Services Section.

Fire prevention activities aimed at reducing the State's fire death rate are managed by the Public Fire Safety Education Section. Activities include the distribution of smoke detectors, programs in the schools to educate youth and the dissemination of timely fire safety information to the public.

*Flood hazard mitigation activities:* The State Fire Marshal has regulatory authority over certain properties and conducts an education program. Both of these could support mitigation activities.

Contact: Pam Deweese  
*pam@fire.llr.sc.edu*  
141 Monticello Trail  
Columbia, SC 29203  
(803) 896-9802  
(803) 896-9806 fax

### ***5.1.9. Department of Natural Resources***

#### ***Land, Water and Conservation Division***

**Flood Mitigation Office** The Flood Mitigation Office administers the National Flood Insurance Program (NFIP) with financial support from the Federal Emergency Management Agency (FEMA).

Activities include:

- ! Monitoring communities for compliance with the Federal regulations
- ! Publishing newsletters
- ! Assisting the public and private sector with floodplain determinations
- ! Flood hazard mitigation advice and assistance
- ! Flood Mitigation Assistance Program grants
- ! Assisting communities in reconstruction practices after a disaster

- ! Providing engineering support for hydrologic and hydraulic studies for communities
- ! Providing information on flood insurance
- ! Supporting the South Carolina Association for Hazard Mitigation

*Flood hazard mitigation activities:* All of this office's duties are flood hazard mitigation activities. The Flood Mitigation Assistance Program has an annual budget of up to \$200,000 - \$300,000 to help fund local mitigation planning or mitigation projects, such as acquisition or elevation of floodprone buildings.

Contact: Lisa Holland  
*holland@water.dnr.state.sc.us*  
 Flood Mitigation Program  
 2221 Devine Street, Suite 222  
 Columbia, SC 29205  
 (803) 734-9120  
 (803) 734-9200 fax

**State Hydrologist** This office manages the data from 100+ stream gages and other water resource information.

*Flood hazard mitigation activities:* The State Hydrologist is developing 3 major projects that will benefit floodplain management and the State Emergency Preparedness Division (EPD). The first project is the creation of a hydrologic model that will utilize realtime rainfall and stream flow data. This will be combined with floodplain maps to indicate where flooding will occur. The information will be available in both a book form and on the Internet (<http://water.dnr.state.sc.us>).

Currently flood stages have only been set for 20 stream gages. The second project is to develop flood stages for all gages to determine at what level floods will cause damage. This will make real time gage data more useful to emergency management personnel during a flood.

The third project is to calculate the additional runoff created by different types of development, such as housing or shopping centers. This will assist communities in determining what size retention system is needed for what type of development. The first community in which this is being tested is Lexington County.

Contact: Rod Cherry	Bud Badr
<i>cherry@water.dnr.state.sc.us</i>	<i>Badr@water.dnr.state.sc.us</i>
State Hydrologist	
Land, Water and Conservation Division	
1201 Main Street, Suite 1100	
Columbia, SC 29201	

(803) 737-0800

(803) 765-9080 fax

**State Climatologist** This office handles an average of 20,000 phone calls and walk-in requests per year along with over 2 million requests via the Internet (<http://water.dnr.state.sc.us/climate/sco>).

The office also serves as the Southeast Regional Climate Center (SERCC), which is one of six regional climate centers in the United States. The SERCC program was created in response to an assessment which identified various user needs for regional climate services in the Southeast.

The office is working to calibrate the Doppler radar system with actual rainfall measurements. The State has installed over 100 rain gauges and put in 10 recording gauges throughout Lexington County. If actual rainfall can be calibrated to the color coding of the Doppler radar system, the State Hydrologist will use this information to enhance the hydrologic model for the Lexington County pilot project.

Overall direction of the Regional Climate Center Program is provided by the National Weather Service and the Climate Prediction Center of the National Oceanographic and Atmospheric Administration. The SERCC serves Alabama, Florida, Georgia, North Carolina, South Carolina, Virginia, Puerto Rico and the U.S. Virgin Islands. Internet address: <http://water.dnr.state.sc.us/climate/sercc>

*Flood hazard mitigation activities:* The office acquires, archives, processes, and disseminates all climate and weather information that is or could be of value to public officials, corporations, and private citizens in the State. Much of this information is made available at little or no charge.

Contact: Mike Helfert  
[helfert@water.dnr.state.sc.us](mailto:helfert@water.dnr.state.sc.us)  
State Climatologist  
Land, Water and Conservation Division  
1201 Main Street, Suite 1100  
Columbia, SC 29201  
(803) 737-0849  
(803) 253-6248 fax

**Conservation Districts** Soil and water conservation districts are political subdivisions which work on floodplain management, best management practices, stormwater management and watershed projects. Currently, the State's conservation districts assist watershed districts that have control over 74 dams and 300 miles of channel.

*Flood hazard mitigation activities:* In addition to the daily work of the conservation districts, this State office coordinates educational and outreach programs. These include teacher workshops, children summer camps, and public outreach activities that work to educate people on environmental issues.

District staff work with individual property owners. Technical advice is provided on conservation tillage, terraces, farm pond design, streambank protection, buffer strips, contour farming, the Wildlife Habitat Incentive Program, and other land conservation techniques that have flood hazard mitigation benefits.

Contact: Von P. Snelgrove  
*snelgrove@water.dnr.state.sc.us*  
Section Chief  
Conservation Districts  
Department of Natural Resources  
Affinity Building  
1201 Main Street, Suite 1100  
Columbia, SC 29201  
(803) 737-0800 ext. 166  
(803) 765-9080 fax

**Nonpoint Source Programs** Nonpoint source pollution refers to water pollution that originates from diverse, usually untreated, sources. The primary concern is stormwater runoff that carries sediment, fertilizers, pesticides, and residue from livestock and industrial operations. This office helps land owners prevent and control nonpoint source pollution by encouraging best management practices.

*Flood hazard mitigation activities:* The office provides technical assistance, conducts demonstration projects, and runs information, education and training programs on its own and in cooperation with other agencies, particularly DHEC. These programs can also promote stormwater management practices that control the quantity of runoff to reduce downstream flooding.

Contact: Mark Corley  
*Corleym@water.dnr.state.sc.us*  
Nonpoint Source Pollution Coordinator  
Department of Natural Resources  
Affinity Building  
1201 Main Street, Suite 1100  
Columbia, SC 29201  
(803) 737-0800 ext. 178  
(803) 765-9080 fax

### ***5.1.10. State Ports Authority***

The South Carolina State Ports Authority is the State agency responsible for planning, designing, financing, constructing and operating public seaport facilities in Charleston, Georgetown and Port Royal. The Authority was created in 1942. Its mission is to contribute to the economic development of South Carolina by stimulating waterborne commerce and shipment of freight through the ports.

*Flood hazard mitigation activities:* The Authority does not have any regulatory authority over port construction. It does inform local entities about the NFIP and Office of Ocean and Coastal Resources Management requirements. As a result new dock facilities are usually built well above mean low water.

Contact: Byron Miller  
scspa@infoave.net  
P.O. Box 22287  
Charleston, SC 29413  
(843) 577-8121  
(843) 577-8127

### ***5.1.11. Department of Transportation***

**Division of Engineering** The Division of Engineering is responsible for the design, engineering and developing of roads and bridges.

*Flood hazard mitigation activities:* As part of their duties they make sure the following regulations are complied with:

- ! Federal Highway Administration's Federal-Aid Policy Guide, 23 CFR 650A;
- ! The Federal Emergency Management Agency Regulations, 44 CFR Ch. 1;
- ! The Environmental Protection Agency's (EPA) National Pollution Discharge Elimination System regulations as administered under general permit by the Department of Health and Environmental Control; and
- ! Departmental policy.

The Department requires an "encroachment permit" of any development that proposes to bring runoff to the highway drainage system. If the area is 2 acres or larger, the application must include an approved Stormwater Management and Sediment Control Plan. If the area is less than 2 acres, the application must include a drainage plan and show that the post construction 10-year peak discharge is limited to the pre-development 10-year peak. In cooperation with communities, SCDOT conducts flood studies for bridge design. The results of

these studies can be used in floodplain regulatory programs.

Contact: Bill Hulbert  
*hulbertwh@dot.state.sc.us*  
955 Park Street  
Columbia, SC 29201  
(803) 737-1658  
(803) 737-9868 fax

#### ***5.1.12. South Carolina Sea Grant Consortium***

The South Carolina Sea Grant Consortium is an independent state agency, is a university-based network supporting research, education and outreach to conserve coastal resources and enhance economic opportunities. The Consortium undertakes a diverse range of initiatives to improve the understanding of the region's coastal resources and the ability to manage them for long-term benefits. It is a member of the National Sea Grant College Program.

Member institutions include:

- ! Clemson University
- ! Coastal Carolina University
- ! College/University of Charleston
- ! Medical University of South Carolina
- ! South Carolina State University
- ! Department of Natural Resources, Marine Resources Division
- ! The Citadel
- ! University of South Carolina

The Consortium has six major program areas within which it operates, including Coastal Hazards. The goal of the SC Sea Grant Coastal Hazards program is to contribute to the reduction of social and economic losses due to coastal hazards through a coordinated program of research, outreach and education. Examples of Consortium work include:

- ! Analysis of insurance loss records from Hurricanes Hugo and Andrew to better understand the damage done to homes from the forces of hurricane winds and water.
- ! Development of a GIS-based computer model which increases the understanding of hurricane wind fields and helps to produce better estimates of hurricane wind and water damage.
- ! Research into the physical processes which influence patterns of coastal

erosion and accretion, and the implications on coastal land-use decisions.

- ! Transfer of research-based hazards reduction methods and materials at the 113 Calhoun St. Multi-Hazard Residential Retrofit demonstration project in Charleston.
- ! Collaboration with other agencies of government (local, state, federal) and the private sector to increase awareness of coastal hazards and develop strategies for reducing resulting losses.
- ! Active participation in the Association for Hazard Mitigation, the Hazard Mitigation Roundtable and the Charleston County Project Impact “Disaster Resistant Community” effort.

The Sea Grant Extension Program is the program’s outreach arm. It is a member of the Extension Disaster Education Network (EDEN). EDEN is a collaborative multi-state effort by Extension Services across the country to improve the delivery of services to citizens affected by disasters. Its web site provides access to resources on disaster preparedness, recovery, and mitigation that will enhance their short and long term programming efforts. The web site database is designed for use by extension agents and educators, but is open to the general public.

Contact: Bob Bacon  
*baconrh@musc.edu*  
Sea Grant Extension Program  
287 Meeting Street  
Charleston, SC 29401  
(843) 727-2075  
(843) 727-2080 fax

EDEN Web site:  
*<http://www.aces.uiuc.edu/~eden/>*  
  
Web site for the Sea Grant:  
*<http://www.haznet.org/>*

### ***5.1.13. University of South Carolina***

**Hazards Research Lab** The Hazards Research Lab is a research and student training lab focusing on the use of geographic information processing techniques in environmental hazards analysis and management. Recent projects include:

- ! A project integrating National Weather Service Doppler radar (WRS-88) data with hydrologic data in a geographic information system in order to improve flood forecasts and investigate the threat of dam failures;
- ! Development of a digitally-based atlas of environmental risks and natural hazards for South Carolina to enhance the public’s understanding of risks and hazards that affect them;
- ! Development of an active learning module on environmental hazards to foster critical thinking and problem-solving skills for students;

- ! A study of residents in Hilton Head, Myrtle Beach, and Wilmington, NC on their evacuation behavior in response to 1996's Hurricane Fran;
- ! A survey of Myrtle Beach residents' evacuation behavior before 1998's Hurricane Bonnie;
- ! Development of national hazards event and loss database as part of the Natural Hazards Center (Boulder, CO) Second Assessment project; and
- ! Baseline hazards assessment for Georgetown County including an inventory and geographic coverage of hazards and vulnerable populations and infrastructure.

Contact: Susan Cutter  
*Scutter@garnet.cla.sc.edu*  
 Department of Geography  
 University of South Carolina  
 Columbia, SC 29208  
 (803) 708/747-5273-5236  
 (803) 708/747-5273-4972 fax

Web site:  
<http://www.cla.sc.edu/geog/hrl>

## ***5.2. Federal Agencies***

### ***5.2.1. U. S. Army Corps of Engineers***

**Flood Plain Management Services Program** The Corps of Engineers can provide technical assistance and planning guidance within authority and funds provided under the Corps Flood Plain Management Services Program. The Savannah District provides the following services in the western counties of Abbeville, Aiken, Allendale, Anderson, Barnwell, Beaufort, Edgefield, Greenwood, Hampton, Jasper, McCormick, Oconee and Pickens. The Charleston District covers the rest of the State.

*Flood hazard mitigation activities:*

#### **Technical Services**

- ! Flood hazard evaluations
- ! Flood discharge, stage, frequency, and duration determinations
- ! Other flood plain data interpreted or developed

#### **Special Studies**

- ! Flood profiles, flood boundary maps, floodway boundary maps
- ! Flood forecast, warning, and preparedness studies
- ! Dam break analysis
- ! Stormwater management, reduction, and detention studies

- ! Flood stage, extent, and damage surveys
- ! Flood plain management and coastal storm awareness workshops
- ! Hydrologic and hydraulic modeling techniques workshops
- ! Hurricane evacuation studies

### **Guides, Pamphlets, and Supporting Studies**

- ! Flood proofing manuals
- ! Flood plain management, regulations, and planning guidance
- ! Natural and beneficial flood plain values

<p>Contact: Chris Mack  <i>Cmack@sac.usace.army.mil</i>          P.O. Box 919          334 Meeting Street          Charleston, SC 29402-0919          (843) 727-4682          (843) 727-4260 fax</p>	<p>Rodger Menzies, Special Projects  <i>rodger.k.menzies@sas02.usace.army.mil</i>          U.S. Army Corps of Engineers          P.O. Box 889          Savannah, GA 31402-0889          (912) 652-5814          (912) 652-5787 fax</p>
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**Permits** The Charleston District handles the 404 wetland permits for the entire State of South Carolina. This program is discussed in more detail in Section 3.3.1. The Corps also issues “Section 10” permits for construction projects in navigable waters.

Contact: Robert Riggs, Chief Regulatory Branch  
*Rriggs@sac.usace.army.mil*  
 Charleston District  
 U.S. Army Corps of Engineers  
 P.O. Box 919  
 Charleston, SC 29402-0919  
 (843) 727-4607  
 1-800-208-2054  
 (803) 727-4445 fax

### ***5.2.2. U. S. Department of Agriculture***

**Natural Resources Conservation Service (NRCS)** NRCS is the Federal government’s lead agency for flood control in drainage areas under 250,000 acres (larger drainage areas are handled by the Corps of Engineers).

County and State office personnel provide technical information on land use planning, natural resource planning, resource development, water management and flood prevention to farmers, community officials, and land developers. NRCS also plans and funds flood prevention projects. NRCS assists communities and

individuals in the recovery from watershed emergencies by providing financial and technical assistance.

*Flood hazard mitigation activities:* NRCS can assist local officials with review of subdivision proposals, erosion and sedimentation control and other development plans for their impact on natural systems, including flooding. NRCS cooperates with communities by conducting flood hazard and floodplain studies.

Following a disaster, NRCS can purchase and set aside floodplain easements under the Emergency Watershed Program. This is a voluntary program that can only be used on vacant agricultural land. It may be used in conjunction with other programs that purchase and remove flooded structures. (More information can be found on the NRCS' national home page, <http://www.nrcs.usda.gov>).

Contact: Walley Turner  
Walley.turner@sc.usda.gov  
Natural Resources Conservation Service  
Strom Thurmond Federal Building  
1835 Assembly Street, Room 950  
Columbia, SC 29201  
(803) 253-3314  
(803) 253-3670 fax

### ***5.2.3. U. S. Department of the Interior***

**Geological Survey (USGS)** The USGS performs surveys, investigations and research covering topography and maps, geology, hydrology, and the mineral and resources of the United States. It classifies lands as to their mineral water resources and publishes and disseminates data relative to the foregoing activities.

*Flood hazard mitigation activities:* The USGS publishes flow rates and peak flows for gages located on certain streams and rivers. The agency has a cooperative program that shares the cost of new gages with state or local agencies. It can also prepare new floodplain maps under a cost-share program.

In addition, the USGS can provide:

- ! Factual information on flood peaks and discharges, flood depths and velocities, profiles of the water surface and areas inundated during major floods, time-of-travel of flood wave, and sediment transport information;
- ! Interpretative information regarding flood frequency relations, estimates of 10-, 50-, 100-, and 500-year flood discharges, computed water surface profiles, and flood-prone areas delineated on topographic maps;
- ! Assistance in minimizing flood losses by quickly identifying areas of

- potential flood hazards; and
- ! Additional information on the hydrology of floodplains.

Contact: Noel Hurley  
*nmhurley@usgs.gov*  
720 Gracern Road, Suite 129  
Columbia, SC 29210-7651  
(803) 750-6126  
(803) 750-6181 fax

**Fish and Wildlife Service** The U.S. Fish and Wildlife Service reviews 404 permits for their impact on jurisdictional wetlands, game and fish. The agency only makes suggestions to the Corps of Engineers which has the permit issuing authority. This program is discussed in more detail in Section 3.3.1. The office also supports wetland mapping.

The Charleston office reviews Coastal Barriers Resources System (COBRA) maps and makes determinations whether properties are located in or out of a COBRA zone. This program is discussed in more detail in Section 3.3.4.

Contact: Charlie Storrs  
*charlie\_storrs@fws.gov*  
Wetland Inventory Coordinator  
U.S. Fish and Wildlife Service  
1875 Century Blvd., Suite 200  
Atlanta, Georgia 30345  
(404) 679-7129  
(404) 679-7081 fax

Roger Banks  
*roger.banks@fws.gov*  
Field Superintendent  
U.S. Fish and Wildlife Service  
P.O. Box 12559  
Charleston, SC 29422  
(843) 727- 4707 ext. 15  
(843) 727-4218 fax

#### ***5.2.4. Federal Emergency Management Agency (FEMA)***

**Mitigation Directorate** FEMA is the focal point within the Federal government for emergency planning, preparedness, mitigation, response and recovery. The Agency works closely with State and local governments by funding emergency programs and providing technical guidance and training. These coordinated activities at the Federal, State, and local levels ensure a broad based emergency program to protect public safety and property.

*Flood hazard mitigation activities:* Within FEMA, the Mitigation Directorate manages:

- ! The post disaster Hazard Mitigation Grant Program (administered by the South Carolina Emergency Preparedness Division)
- ! The National Flood Insurance Program (NFIP) which helps states, local

communities and private entities interpret the Federal regulations (supported by the DNR's Flood Mitigation Office).

- ! Flood Mitigation Assistance (FMA), which funds states and local planning and mitigation projects (administered by the Flood Mitigation Office).

**NFIP and FMA Contact:**

David L. Thomas  
*Davidl.thomas@fema.gov*  
FEMA Region IV  
3003 Chamblee-Tucker Road  
Atlanta, GA 30341  
(770) 220-5457  
(770) 220-5440 fax

**Hazard Mitigation Grant Program:**

Ernest Hunter  
*ernest.hunter@fema.gov*  
FEMA Region IV  
3003 Chamblee-Tucker Road  
Atlanta, GA 30341  
(770) 220-4195  
(770) 220-5440 fax

**National Flood Insurance Program - Community Rating System** The Insurance Services Office, Inc. (ISO) is the contractor which reviews Community Rating System (CRS) applications, and verifies the communities' credit points. *Flood hazard mitigation activities:* CRS is a program that encourages communities to implement floodplain management and hazard mitigation programs that exceed the minimum Federal NFIP standards in order to receive lower flood insurance premiums. There are 27 communities in South Carolina that participate in the CRS program (see page 4-1).

Contact: David Van Troost  
*Dvantroost@iso.com*  
4250 Poplar Springs Road  
Gainesville, GA 30507  
(770) 536-3039  
(770) 536-3039 fax

**National Flood Insurance Program - Bureau and Statistical Agent** This office works under contract to FEMA to train insurance agents and lenders through workshops and individual visits. It covers South Carolina and seven other southeastern states. This office does not process insurance applications or handle policy files at its Georgia location, but the staff can provide assistance to agents and lenders.

Contact: Roger Widdifield, Manager  
*Rogerwiddifield@worldnet.att.net*  
National Flood Insurance Program  
Suite 200  
1532 Dunwoody Village Parkway

Dunwoody, GA 30338  
(770) 396-9117  
(770) 396-7730 (fax)

### ***5.2.5. National Oceanic and Atmospheric Administration***

**National Weather Service** The mission of the National Weather Service is to provide weather and flood warnings, public forecasts and advisories for the protection of life and property. National Weather Service data and products are provided to private meteorologists for the provision of all specialized services.

The Office of Hydrology serves as the primary link between the National Weather Service Headquarters and the field service programs. The Office of Hydrology provides administrative, policy and technical guidance for hydrologic matters at a national level within the National Weather Service, and coordinates interagency matters in the field of operational hydrology.

*Flood hazard mitigation activities:* The Office of Hydrology collects and processes hydrologic data for river and flood forecasts and warnings and water-supply forecasts. Access to some of this information can be made through the Service's home page, <http://www.nws.noaa.gov>.

Contact: Shari Ireland  
[sheri.ireland@noaa.gov](mailto:sheri.ireland@noaa.gov)  
2015 Gardner Dr.  
Wilmington, NC 28405  
(800) 697-3901  
(910) 762-1288 fax

Tom Ardrey  
[thomas.ardrey@noaa.gov](mailto:thomas.ardrey@noaa.gov)  
2909 Aviation Way  
W. Columbia, SC 29170-2102  
(803) 822-8037  
(803) 822-8188 fax

Pat Tanner  
[patricia.tanner@noaa.gov](mailto:patricia.tanner@noaa.gov)  
1549 GSP Drive  
Greer, SC 29651  
(864) 879-1085  
(864) 848-1582 fax

Mike Rapsik  
[mike.rapsik@noaa.gov](mailto:mike.rapsik@noaa.gov)  
5777 South Aviation Ave.  
Charleston, SC 29406  
(843) 554-0197  
(843) 747-5405 fax

**Coastal Service Center** The mission of this office is to bridge the gap between scientists and resource managers by combining staff resources, new technologies and outside expertise to address problems related to the coast.

*Flood hazard mitigation activities:* The Center has a coastal hazards program that works with both FEMA and NOAA's Office of Ocean and Coastal Resources Management mitigation programs. The Center identifies information and technology gaps and develops products and research activities to help fill them.

The Center's primary focus is on hazard identification, risk assessment, applied research and technology transfer. The Center promotes the use of hazard information and technology and helps State and local officials with public awareness, training and coordination.

Contact: Sandy Ward  
*sward@csc.noaa.gov*  
NOAA Coastal Services Center  
Coastal Hazards Program  
2234 Hobson Ave  
Charleston, SC 29408  
(843) 740-1311 or (800)789-2234

### ***5.3. Associations***

#### ***5.3.1. American Planning Association***

The South Carolina Chapter of the American Planning Association (SCAPA) has over 400 members, most of them working in local government. Its goals include professional development and the advancement of planning issues at the local, State and Federal levels.

The Association holds four meetings every year which focus on training and sharing information with the members. SCAPA is also represented on several state advisory bodies that address issues such as mapping and land stewardship.

Contact: Michael P. Criss, AICP  
SCAPA  
*Criss@water.dnr.state.sc.us*  
c/o Department of Natural Resources  
Land, Water and Conservation Division  
2221 Devine St, Suite 222  
Columbia, SC 29205-2474  
(803) 734-9494  
(803) 734-9200 fax

#### ***5.3.2. Municipal Association of South Carolina***

The Municipal Association of South Carolina is a nonpartisan, not-for-profit association representing the 271 incorporated municipalities in South Carolina. The Association provides elected and appointed officials with educational opportunities, technical and legal assistance, a concentrated lobbying effort in the

General Assembly, insurance programs and information through a variety of publications.

The Association has nine programs:

- |                                       |                        |
|---------------------------------------|------------------------|
| ! Legislative                         | ! Technical assistance |
| ! Insurance                           | ! Collection           |
| ! Risk management and safety services | ! Information services |
| ! Communications                      | ! Trade certification  |
| ! conferences/training                |                        |

*Flood hazard mitigation activities:* The Association is one of the primary sources of information and education for municipal officials.

Contact: Howard Duvall  
*Hduvall@masc.state.sc.us*  
1529 Washington Street  
Columbia, SC 29211  
(803) 799-9574  
(803) 799-9520 fax

### ***5.3.3. South Carolina Community Development Association***

SCCDA provides a forum for learning about the community development process. Members include municipal, county, regional and state community development professionals; employees of private companies; and elected officials and volunteers.

SCCDA offers practical information and techniques through workshops and seminars on community development topics, such as housing, infrastructure planning and financing, downtown revitalization and Federal and State funding programs.

The Association receives staff and administrative support from the Municipal Association of South Carolina.

Contact: Miriam Haire  
*mhaire@masc.state.sc.us*  
P.O. Box 12109  
Columbia, SC 29211  
(803) 799-9574  
(803) 933-1299 fax

#### ***5.3.4. National Trust for Historic Preservation***

This nonprofit organization provides programs and services that help preserve historic buildings, districts and other landmarks. These programs support the work of nonprofit organizations, governments, and historic property owners. The Trust provide grants and loans for preservation projects and for professional assistance in support of local preservation projects.

The National Trust provides financial assistance for preservation projects to nonprofit organizations and governmental entities. It also operates an Information Clearinghouse for preservationists.

*Flood hazard mitigation activities:* The National Trust provided disaster response assistance for historic resources at risk throughout the region, including Hurricane Hugo (1989) and Hurricane Fran (1996).

Contact: John Hildreth  
soro@nthp.org  
Director of Southern Region  
National Trust for Historic Preservation  
456 King St.  
Charleston, SC 29403  
(843) 722-8552  
(843-722-8652 fax

#### ***5.3.5. South Carolina Association of Counties***

The Association is a nonpartisan, nonprofit organization. Membership includes elected and appointed county officials from all 46 counties in the State. It represents county governments, not county employees.

Each year the Association sponsors three major conferences: the Annual Conference held in August, the Legislative Conference held in December, and the Mid-Year Conference held in late winter.

Services that are provided by the South Carolina Association of Counties are: legislative information, research and technical assistance, education, public information, legal assistance, self-insurance pools, and the setoff debt collection program.

*Flood hazard mitigation activities:* The Association is one of the primary sources

of information and education for county officials.

Contact: Kathy Williams  
*Kathy@scac.state.sc.us*  
P.O. Box 8207  
Columbia, SC 29202  
(803) 252-7255  
(803) 252-0379 fax

#### ***5.3.6. South Carolina Association for Hazard Mitigation***

The South Carolina Association for Hazard Mitigation is only in its second year and is a chapter of the Association of State Floodplain Managers. Its goal is to take a multi hazard approach to the State's natural hazards as opposed to dealing just with floodplain management issues.

*Flood hazard mitigation activities:* The Association is a resource for all hazard mitigation personnel. Every other month, the Association meets for an informal round table to discuss local problems.

Contact: Peggy Lee  
*Plee@doi.state.sc.us*  
Property & Casualty Division  
Department of Insurance  
1612 Marion Street  
PO Box 100105  
Columbia, SC 29202  
(803) 737-6164  
(803) 737-6233 fax

#### ***5.3.7. South Carolina Environmental Education Association***

This organization is dedicated to promoting natural resources. Its primary audiences are teachers and educators at all levels. Each year, the Association gives scholarships and awards for natural resource work, publishes 4 newsletters, and holds 2 conferences.

Contact: Ms. Rhet Wilson, President  
*Wilson@scaquarium.org*  
Director of Education  
South Carolina Aquarium  
57 Hasell Street

George Sawyer, Treasurer  
*gsawyer@pascal.coker.edu*  
Kalmia Garden  
Coker College  
1624 W. Carolina Ave.

Charleston, SC 29401  
(843) 720-1990  
(843) 720-3861 fax

Hartsville, SC 29550  
(843) 383-8145  
(843) 383-8149 fax

#### ***5.4. Councils of Government***

The State of South Carolina has 10 councils of government that include all 46 counties. These are local organizations that cover three to six counties. They provide various services to their member communities. They can be particularly helpful in training and technical assistance in preventive mitigation activities.

##### **Appalachian Council of Governments**

Counties: Anderson, Cherokee, Greenville, Oconee, Pickens, Spartanburg

Director: Bob Strother  
Telephone: 864-242-9733 Fax: 864-242-6957

Post Office Drawer 6668  
Greenville, SC 29606

##### **Upper Savannah Council of Governments**

Counties: Abbeville, Edgefield, Greenwood, Laurens, McCormick, Saluda

Director: Patricia Edmonds  
Telephone: 864-941-8050 Fax: 864-941-8090

Post Office Box 1366  
Greenwood, SC 29646

##### **Catawba Regional Planning Council**

Counties: Chester, Lancaster, Union, York

Director: Harold Shapiro  
Telephone: 803-327-9041 Fax: 803-327-1912

Post Office Box 450  
Rock Hill, SC 29731

##### **Central Midlands Council of Governments**

Counties: Fairfield, Lexington, Newberry, Richland

Director: Doug Phillips  
Telephone: 803-376-5390 Fax: 803-376-5394

236 Stoneridge Drive  
Columbia, SC 29210

**Lower Savannah Council of Governments**

Counties: Aiken, Allendale, Bamberg, Barnwell, Calhoun, Orangeburg

Director: Eric Thompson  
Telephone: 803-649-7981 Fax: 803-649-2248

Post Office Box 850  
Aiken, SC 29802

**Santee-Lynches Council of Governments**

Counties: Clarendon, Kershaw, Lee, Sumter

Director: Jim Darby  
Telephone: 803-775-7381 Fax: 803-773-9903

Post Office Box 1837  
Sumter, SC 29151

**Pee Dee Regional Council of Governments**

Counties: Chesterfield, Darlington, Dillon, Florence, Marion, Marlboro

Director: Johnny Brown  
Telephone: 803-669-3138 Fax: 803-669-0511

Post Office Box 5719  
Florence, SC 29502

**Waccamaw Regional Planning & Development Council**

Counties: Georgetown, Horry, Williamsburg

Director: C. Kenneth Thompson  
Telephone: 803-546-8502 Fax: 803-527-2302

1230 Highmarket Street  
Georgetown, SC 29440

**Berkeley-Charleston-Dorchester Council of Governments**

Counties: Berkeley, Charleston, Dorchester

Director: Ron Mitchum  
Telephone: 803-529-0400 Fax: 803-529-0305

5290 Rivers Avenue, Suite 400  
North Charleston, SC 29406-6357

**Lowcountry Council of Governments**

Counties: Beaufort, Colleton, Hampton, Jasper

Director: L. Chris Bickley

Telephone: 803-726-5536 Fax: 803-726-5165

Post Office Box 98  
Yemassee, SC 29945

### 5.5. Matrix of Agencies and Mitigation Activities

	Coastal Flooding	Riverine Flooding	Flood Hazard Data/Map	Planning Assistance	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Projects	Public Information
<b>STATE AGENCIES</b>										
State Building & Property Services	yes	yes				S				
Office of Insurance Services	yes	yes				F				
Public Assistance Program	yes	yes				F				
State Engineer's Office	yes	yes			R				T	
State Geodetic Survey	yes	yes	ST		T					
Emergency Preparedness Division	yes	yes		FST	ST	FS		FST		ST
State Historic Preservation Office	yes	yes			R	R				
Block Grant Program	yes	yes				F			F	
School District Facilities Management	yes	yes		FT	FTR	FTR		T	FTR	
Environmental Quality Control	yes	yes			R	R	R		R	
Construction and Stormwater Mgmt	yes	yes					R		R	
Dam and Reservoir Safety		yes							R	T
Erosion and Sediment Control		yes					R			
Coastal Resources Management	yes				R		R		RT	T
Mining and Solid Waste Permitting	yes	yes					RT			
Health Facilities & Services Development	yes	yes		R	R			S		
Department of Insurance	yes	yes		FT	R	RF				
Real Estate and Building Code Prof	yes	yes			R					
Manufactured Housing Board	yes	yes			R					T
State Fire Marshal	yes	yes			R	ST		ST		ST
Flood Mitigation	yes	yes	ST	FST	T	FT	T	T	T	ST
State Hydrologist		yes			T			ST		ST
State Climatologist	yes	yes		ST				RST		RST
Conservation Districts	yes	yes	T		T				T	T
Nonpoint Source Programs		yes			T		T			T
Ports Authority	yes				R					T
Transportation - Engineering		yes	ST		R					T
Sea Grant Consortium	yes	yes				T	T	T	T	T
USC - Hazards Research Lab	yes	yes	T	T			T	T		T

<b>Key:</b>										
<i>F - Agency provides financial assistance</i>										
<i>R - Agency regulates or sets regulatory standards</i>										
<i>S - Agency performs service directly with its own staff</i>										
<i>T - Agency provide technical assistance, information or reference materials</i>										

	Coastal Flooding	Riverine Flooding	Flood Hazard Data/Map	Planning Assistance	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Projects	Public Information
<b>FEDERAL AGENCIES</b>										
Corps of Engineers - Floodplain Management	yes	yes	ST	T	FT	FT	ST	ST	FT	T
Corps of Engineers - Wetlands Permitting	yes	yes	T				RST			
Natural Resources Conservation Service	yes	yes	FST	T	T	ST	FST	FST	FT	T
U. S. Geological Survey	yes	yes	FST	T						T
Fish and Wildlife Service	yes	yes	T				ST			T
FEMA - Mitigation Directorate	yes	yes	FST	FST	RST	FT	T	FST	ST	ST
Community Rating System	yes	yes		T	T	T				T
NFIP - Bureau and Statistical Agency	yes	yes				T				T
National Weather Service	yes	yes						ST		T
Coastal Services Center	yes		T	T						ST
<b>ASSOCIATIONS</b>										
American Planning Association	yes	yes		T						T
Municipal Association of South Carolina	yes	yes								T
Community Development Association	yes	yes		T	T					
National Trust for Historic Preservation	yes	yes		T		FT				
South Carolina Association of Counties	yes	yes								T
Association for Hazard Mitigation	yes	yes	T	T	T	T	T	T	T	T
Environmental Education Association	yes	yes	T				T			T
<b>COUNCILS OF GOVERNMENT</b>	yes	yes	Services vary from COG to COG							
<b>Key:</b>										
<i>F - Agency provides financial assistance</i>										
<i>R - Agency regulates or sets regulatory standards</i>										

<i>S - Agency performs service directly with its own staff</i>						
<i>T - Agency provide technical assistance, information or reference materials</i>						



## 6. Action Plan

The Flood Hazard Mitigation Advisory Committee developed 44 recommendations to implement a variety of activities by State and Federal agencies. The recommendations are in the form of action items. The numbers after each action item relate to the mitigation activities reviewed in Chapter 4.

Each action item has lead and supporting agencies identified. All lead agencies are state agencies. The following abbreviations are used for these agencies:

EPD	Emergency Preparedness Division, Office of the Adjutant General (see section 5.1.2)
FEMA	Federal Emergency Management Agency (see section 5.2.4)
FMCC	Flood Mitigation Coordinating Committee (see section 6.1.1)
LWC/DNR	Land and Water Conservation Division, Department of Natural Resources, usually referring to the Flood Mitigation Office (see section 5.1.9)
NRCS	Natural Resources Conservation Service, U.S. Department of Agriculture (see section 5.2.2)
NWS	National Weather Service (see section 5.2.5)
OCRM	Office of Ocean and Coastal Resources Management, Department of Health & Environmental Control (see section 5.1.6)
USGS	U.S. Geological Survey (see section 5.2.3)
DOI	South Carolina Department of Insurance (see section 5.1.7)

Each action item also has a deadline listed. Deadlines are either “ongoing” (for programs that should continue) or a number of months or years after this plan is adopted. *[Note: This draft does not include deadlines. Deadlines will be recommended by the Advisory Committee after receiving input from the agencies that review this draft.]*

### 6.1. *Coordinate State and Federal flood mitigation programs so they will operate more effectively and efficiently.*

- 6.1.1. Establish a Flood Mitigation Coordinating Committee (FMCC). Membership would be open to all agencies that are listed as lead or supporting agencies for these action items. Other agencies and organizations would be invited to attend meetings. The Committee would be chaired by an ap-

pointee of the Director of the Department of Natural Resources. The Flood Mitigation Office would provide staff support to the Committee.

The Committee's primary duties would be to:

- A. Act as a forum to communicate the status of Federal, State and local flood hazard mitigation programs.
- B. Review conflicts between Federal, State and local plans and programs and recommend solutions.
- C. Monitor implementation of this plan's recommendations, evaluate progress and make appropriate revisions.
- D. Review and improve the flood-related sections of the State Water Plan.
- E. Communicate and coordinate with the Interagency Coordinating Committee of the Emergency Preparedness Division and the Advisory Committee to the Building Codes Council.

Lead agency: LWC/DNR

Supporting agencies: All agencies and organizations listed in this Plan.

Deadline:

- 6.1.2. Encourage other organizations, such as land trusts, utility companies, and professional groups to participate in FMCC activities and encourage Committee members to participate in professional mitigation associations. (4.2.5)

Lead agency: FMCC

Supporting agency: LWC/DNR

Deadline:

- 6.1.3. Clarify and simplify the flood mitigation responsibilities currently undertaken by the Department of Natural Resources, the Emergency Preparedness Division, and the Budget and Control Board.

Lead agency: FMCC

Supporting agencies: LWC/DNR, EPD, Budget and Control Board

Deadline:

- 6.1.4. Establish a post-disaster mitigation coordinating mechanism. (4.4.6) The mechanism should:

- A. Ensure that State and Federal programs will encourage and support reconstruction and redevelopment activities that will reduce flood losses.
- B. Prepare/update a State flood recovery plan that identifies post-flood recovery and mitigation responsibilities and procedures that can

quickly identify mitigation opportunities before people and communities rebuild.

C. Be coordinated with action item 6.6.3.

Lead agency: FMCC

Supporting agencies: EPD, LWC/DNR

Deadline:

- 6.1.5. Identify research needs and coordinate research activities to support mitigation programs.

Lead agency: FMCC

Supporting agencies: Sea Grant Consortium, USC Hazards Research Lab

Deadline:

**6.2. *Provide flood data and maps to support mitigation programs.***

See also action items 6.5.1, 6.5.2 and 6.5.3.

- 6.2.1. Establish a river gage priority system to identify where additional gages are most needed. (4.4.1, 4.6.1)

Lead agency: LWC/DNR

Supporting agencies: USGS, NWS, State Hydrologist, SCDOT

Deadline:

- 6.2.2. Evaluate the needs for Flood Insurance Rate Maps (FIRMs) and establish a mapping priority system. (4.6.1)

Lead agency: LWC/DNR

Supporting agency: FEMA

Deadline:

- 6.2.3. Improve the process for revising FIRMs and ensure that they are updated when a State or Federal flood control project is completed. (4.6.1)

Lead agency: LWC/DNR

Supporting agency: FEMA

Deadline:

- 6.2.4. Complete the National Wetlands Inventory or other wetland identification maps for the balance of the State to facilitate wetland protection regulations. (4.3.1)

Lead agency: LWC/DNR

Supporting agencies: U.S. Fish & Wildlife Service, NRCS

Deadline:

- 6.2.5. Survey in permanent elevation reference marks when bridges and other public facilities are replaced (4.6.1).

Lead agency: State Geodetic Survey

Supporting agencies: U.S. Geological Survey, U.S. Coast and Geodetic Survey, South Carolina Department of Transportation

Deadline:

**6.3. *Regulate future development to prevent increasing flood hazards and losses.***

- 6.3.1. Review recent research findings and agency lessons learned and develop a master set of floodplain construction standards appropriate for State and local regulatory programs. (4.1.3, 4.1.4, 4.1.5, 4.3.3, 4.4.4)

Lead agency: FMCC

Supporting agencies: all regulatory agencies

Deadline:

- 6.3.2. Ensure that Federal programs comply with Executive Orders 11988 and 11990 on development in floodplains and wetlands. (4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.5.1)

Lead agency: LWC/DNR

Supporting agencies: all Federal agencies

Deadline:

- 6.3.3. Update the 1982 Governor's Executive Order on floodplain management in light of lessons learned and current State agency organization and responsibilities (4.1.4). The updated Order should address construction standards for State funded projects in communities not in the National Flood Insurance Program (4.1.3).

Lead agency: FMCC

Supporting agencies: All State agencies

Deadline:

- 6.3.4. Assist and encourage communities to adopt and enforce erosion and sediment control and stormwater management standards that address storms larger than the DHEC minimum water quality criteria.(4.1.5, 4.3.2, 4.3.3)

Lead agency: Office of Environmental Quality Control, Department of  
Health & Environmental Control

Supporting agencies: LWC/DNR, NRCS, Environmental  
Protection Agency

Deadline:

See also action items 6.6.4 and 6.6.5.

#### ***6.4. Protect existing development from flood damage.***

- 6.4.1. Prepare a profile of the State's flood hazard exposure by assembling the following database. Update these databases over time to measure progress in reducing the State's exposure to flood damage. The database should be assembled as data can be collected, beginning with coastal and other high exposure areas.

A. An inventory of floodprone critical facilities (4.4.4)

Lead agency: EPD

Supporting agencies: All State agencies

Deadline:

B. An inventory of floodprone State-owned properties that are located in floodplains

Lead agency: LWC/DNR

Supporting agencies: All State agencies

Deadline:

C. State facilities appropriate for relocation or other mitigation action following a flood. (4.4.4, 4.4.6)

Lead agency: LWC/DNR

Supporting agencies: All State agencies

Deadline:

- 6.4.2. Ensure that all plans for structural flood control projects document consideration of the following. (4.5.1, 4.5.2, 4.5.3, 4.5.4)

A. Nonstructural alternatives,

B. The impact of all alternatives on flooding on other sites, and

C. The impact of all alternatives on habitat and water quality

Lead agency: LWC/DNR

Supporting agencies: NRCS, U.S. Army Corps of Engineers

Deadline:

- 6.4.3. Continue to ensure that all beach protection projects comply with the State's prohibition of seawalls and groins and that communities adopt dune and beach maintenance plans. (4.5.2, 4.5.6)

Lead agency: OCRM

Supporting agency: n/a

Deadline:

See also action items 6.7.1 - 6.7.6

***6.5. Provide warning and emergency response activities to protect lives and property during a flood.***

- 6.5.1. Expand the gaging system and IFLOWS implementation to extend the areas covered by real time data for flood threat recognition. (4.4.1)

Lead agency: LWC/DNR

Supporting agencies: USGS, NWS, State Hydrologist

Deadline:

- 6.5.2. Develop geographic information system technology and computer models to transfer precipitation forecasts and gage data to determine what areas will be flooded.

Lead agency: LWC/DNR

Supporting agencies: NWS, USGS, State Hydrologist

Deadline:

- 6.5.3. Prepare a booklet and/or web site that relates stream gage data to elevation data and the potential damage expected to result at various flood levels. Where feasible, the web site should also show real time and historical flood data. (4.4.2)

Lead agency: LWC/DNR

Supporting agencies: NWS, USGS, State Hydrologist

Deadline:

- 6.5.4. Prominently locate a uniform system of staff gages on all highway underpasses subject to flooding to warn drivers of the depth of the water. Publicize the dangers of driving on a flooded road. (4.4.2)

Lead agency: South Carolina Department of Transportation

Supporting agency: NWS  
Deadline:

- 6.5.5. Assist and encourage communities to develop and implement site-specific gage data and flood warning and response plans (4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5)

Lead agency: EPD  
Supporting agencies: State Hydrologist, LWC/DNR, NWS, OCRM  
Deadline:

- 6.5.6. Provide model documents for local reproduction on flood warnings, flood safety and evacuation procedures. Coastal materials should be oriented to tourists. (4.4.1, 4.4.2, 4.4.3, 4.4.5, 4.6.2)

Lead agency: EPD  
Supporting agencies: LWC/DNR, OCRM  
Deadline:

- 6.5.7. Provide information and model plans to guide owners and managers of floodprone facilities in developing their own site-specific flood response plans. (4.4.4)

Lead agency: EPD  
Supporting agency: N/A  
Deadline:

## ***6.6. Support and improve local mitigation programs.***

See also action items 6.5.5, 6.5.6 and 6.7.1

- 6.6.1. Identify Federal, State and private post-disaster funding programs and determine how they can support mitigation activities. (4.4.6)

Lead agency: FMCC  
Supporting agency: LWC/DNR  
Deadline:

- 6.6.2. Assist and encourage the natural resources elements of local comprehensive plans to address all natural hazards. Land use plans and zoning ordinances should show known flood problem areas and identify land uses appropriate for the hazard. (4.1.1)

Lead agency: South Carolina Chapter, American Planning Association  
Supporting agency: LWC/DNR

Deadline:

- 6.6.3. Assist and encourage communities to develop and implement pre-disaster mitigation plans that identify sites appropriate for redevelopment, acquisition, relocation, elevation and floodproofing projects and that establish post-disaster mitigation procedures. (4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.3.6) See also action item 6.1.4. This should be done with training programs, reference materials, and technical assistance.

Lead agency: LWC/DNR

Supporting agencies: EPD, FEMA

Deadline:

- 6.6.4. Assist and encourage communities to adopt and enforce the floodplain regulation provisions of the Standard Building Code and those more restrictive construction standards appropriate for local flooding conditions. (4.1.3)

Lead agency: Building Codes Council, Department of Insurance

Supporting agency: LWC/DNR

Deadline:

- 6.6.5. Improve local capabilities for managing floodplain development.

- A. Assist and encourage all communities to join the National Flood Insurance Program. (4.1.3)
- B. Provide new training opportunities for local permit officials (4.1.3)
- C. Implement a floodplain manager certification program to encourage local permit officials to become more proficient. (4.1.3)
- D. Expand LWC/DNR and FEMA reviews of local regulatory programs to include more communities each year. (4.1.3)
- E. Add to all State and Federal permits a reminder that the applicant may need a local floodplain construction permit. 4.1.5, 4.3.1, 4.3.2, 4.3.3)

Lead agency: LWC/DNR

Supporting agencies: FEMA, Federal and State regulating agencies

Deadline:

- 6.6.6. Collate and distribute information to communities on open space programs and financial assistance for preserving open space. (4.1.2)

Lead agency: LWC/DNR

Supporting agency: NRCS

Deadline:

6.6.7. Improve local drainage system maintenance.

- A. Assist and encourage communities to develop and implement formal maintenance programs. (4.5.5, 4.5.6)
- B. Provide local governments with clear statutory authority to enter all properties, public and private, within or outside their corporate limits, to remove obstructions or debris that can increase the flood hazard to other properties. (4.5.5)

Lead agency: LWC/DNR

Supporting agency: N/A

Deadline:

6.6.8. Assist and encourage NFIP communities to join the Community Rating System. (4.1.2, 4.1.3, 4.1.4, 4.1.5, 4.2.6, 4.3.2, 4.4.1, 4.4.2, 4.4.2, 4.4.4, 4.5.5, 4.5.6, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5)

Lead agency: LWC/DNR

Supporting agency: FEMA

Deadline:

***6.7. Provide flood protection information to property owners.***

6.7.1. Assist and encourage communities to develop and implement locally appropriate public information programs (4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5, 4.6.6).

- A. Develop a directory of State and Federal agencies that can provide technical backup to local public information programs (4.6.1, 4.6.5, 4.6.6).
- B. Develop and distribute a directory of State and Federal publications that are appropriate for libraries interested in materials that can help their floodprone customers. (4.6.4, 4.6.6)

Lead agency: LWC/DNR

Supporting agencies: EPD, FEMA

Deadline:

6.7.2. Provide information and technical assistance to property owners.

- A. Provide information on methods to protect their properties from flooding. (4.2.3, 4.2.4, 4.2.6, 4.6.2, 4.6.5)

- B. Provide information on flood insurance. (4.2.6, 4.6.2) Provide guidance materials on best management practices (BMPs) (4.3.3, 4.6.6)
- C. Review the educational efforts of State and Federal agencies for opportunities to include materials on flood protection. (4.6.2, 4.6.6)

See also action item 6.5.7.

Lead agency: LWC/DNR

Supporting agencies: EPD, FEMA, NRCS, Department of Health and Environmental Control

Deadline:

- 6.7.3. Work with the Department of Education and local schools to incorporate flood issues in elementary and high school curriculums. (4.6.2, 4.6.6)

Lead agency: LWC/DNR

Supporting agency: Department of Education, Sea Grant Consortium, University of South Carolina Hazards Research Lab, Natural Resources Conservation Service, soil and water conservation districts

Deadline:

- 6.7.4. Improve the information provided to potential purchasers of floodprone property through statutory or regulatory requirements that:

- A. Mandate disclosure of whether a property is in a FEMA mapped Special Flood Hazard Area at the time of the agreement to purchase, such as a notice in the Multiple Listing Service (4.6.3)
- B. Require that lot surveys must identify whether a portion of the lot is in a FEMA mapped Special Flood Hazard Area (4.6.3)

Lead agency: FMCC

Supporting agency: Department of Labor, Licensing & Regulation

Deadline:

- 6.7.5. Increase insurance agents' knowledge of and interest in selling flood insurance. (4.2.6)

Lead agency: Department of Insurance

Supporting agencies: LWC/DNR, FEMA

Deadline:

- 6.7.6. Work with organizations of farmers, businesses and advisors to businesses (e.g., the Association of Contingency Planners) to increase their members'

knowledge of and interest in natural hazard mitigation. (4.3.3, 4.6.2) See also action item 6.1.2

Lead agency: FMCC

Supporting agency: EPD

Deadline:

## ***6.8. Adoption and Implementation***

The success of this *Flood Hazard Mitigation Plan* depends on the cooperation and resources of the implementing agencies. Some action items call for simple changes in policies and directions while others require extensive inventories or other work that would require additional funding.

Therefore, determining priority projects and setting deadlines for the action items will be done only after the agencies have reviewed the draft *Plan*, accepted their assignments, identified deadlines and concurred with the *Plan*. This April 1 draft is being circulated to obtain that feedback.

***Agency concurrence:*** Six state agencies are designated as lead agencies for the action items:

- ! Governor's Office, Budget and Control Board
- ! Office of the Adjutant General, Emergency Preparedness Division
- ! Department of Health & Environmental Control
- ! Department of Insurance
- ! Department of Natural Resources
- ! Department of Transportation

Other agencies and organizations play important supporting roles and are slated to serve on the Flood Mitigation Coordinating Committee. These include:

- ! Department of Archives and History
- ! Department of Commerce
- ! Department of Education
- ! Department of Labor Licensing & Regulations
- ! State Ports Authority
- ! South Carolina Sea Grant Consortium
- ! University of South Carolina, Hazards Research Lab

***Table 6-1a. Summary of Action Items by Lead Agency***

<b>Number</b>	<b>Action Item Recommendation</b>	<b>Deadline</b>
<b>Flood Mitigation Coordinating Committee (FMCC)</b>		
6.1.2	Encourage other organizations to participate in mitigation	
6.1.3	Clarify agency mitigation roles	
6.1.4	Establish a post-disaster mitigation coordinating mechanism	
6.1.5	Identify research needs and coordinate research activities	
6.1.4.B	Prepare/update the State flood recovery plan	
6.3.1	Develop a master set of floodplain construction standards	
6.3.3	Update the 1982 Governor's Executive Order	
6.6.1	Identify post-disaster mitigation funding programs	
6.7.4	Mandate flood hazard disclosure to potential purchasers	
6.7.6	Encourage organizations to increase interest in mitigation	
<b>Land and Water Conservation Division, Department of Natural Resources</b>		
6.1.1	Establish a Flood Mitigation Coordinating Committee	
6.2.1	Establish a river gage priority system	
6.2.2	Evaluate FIRM needs and establish a priority system.	
6.2.3	Improve the process for revising FIRMs	
6.2.4	Complete the wetland identification maps	
6.3.2	Encourage Federal programs to comply with Executive Orders	
6.4.1.B	Inventory floodprone State-owned properties	
6.4.1.C	Identify State facilities appropriate for mitigation action	
6.4.2	Ensure that structural plans look at alternatives	
6.5.1	Expand the gaging system and IFLOWS	
6.5.2	Develop GIS and computer models to determine floodprone areas	
6.5.3	Prepare a booklet or web site on stream gage data	
6.6.3	Assist and encourage local pre-disaster mitigation plans	
6.6.5	Improve local capabilities for floodplain regulations	
6.6.5.C	Implement a floodplain manager certification program	
6.6.6	Distribute information on open space programs	

<b>Table 6-1b. Summary of Action Items by Lead Agency</b>		
<b>Number</b>	<b>Action Item Recommendation</b>	<b>Deadline</b>
<b>Land and Water Conservation Division, Department of Natural Resources (Continued)</b>		
6.6.7.B	Provide clear statutory authority for drainage maintenance	
6.6.7.A	Assist/encourage formal drainage maintenance programs	
6.6.8	Help communities join the Community Rating System	
6.7.1	Create directories of public information agencies/publications	
6.7.2	Get public information materials to property owners	
6.7.3	Include flood issues in school curriculums	
<b>Budget and Control Board, State Geodetic Survey</b>		
6.2.5	Survey elevation reference marks	
<b>Emergency Preparedness Division, Office of the Adjutant General</b>		
6.4.1A	Inventory floodprone critical facilities	
6.5.5	Help communities prepare flood warning/response plans	
6.5.6	Provide model materials on flood warning and response	
6.5.7	Provide model facility flood response plans	
<b>Office of Environmental Quality Control Department of Health &amp; Environmental Control</b>		
6.3.4	Encourage higher erosion and stormwater standards	
<b>Office of Ocean and Coastal Resources Management Department of Health &amp; Environmental Control (OCRM)</b>		
6.4.3	Ensure no new seawalls or groins	
6.6.7	Help develop formal dune/beach maintenance programs	
<b>South Carolina Department of Transportation</b>		
6.5.4	Erect staff gages at highway underpasses	
<b>South Carolina Chapter, American Planning Association</b>		
6.6.2	Help local planning programs address all natural hazards	
<b>Department of Insurance</b>		
6.7.5	Help insurance agents with flood insurance	
<b>Building Codes Council, Department of Insurance</b>		
6.6.4	Help communities to adopt higher floodplain standards	

- ! U.S. Army Corps of Engineers
- ! U.S. Department of Agriculture, Natural Resources Conservation Service
- ! U.S. Department of the Interior
- ! Federal Emergency Management Agency
- ! National Oceanic and Atmospheric Administration
  
- ! South Carolina Chapter, American Planning Association
- ! Municipal Association of South Carolina
- ! South Carolina Community Development Association
- ! Southern Region, National Trust for Historic Preservation
- ! South Carolina Association of Counties
- ! South Carolina Association for Hazard Mitigation
- ! South Carolina Environmental Education Association

Agency, organization and public comments are due to the Flood Mitigation Office by May 31, 1999. The Flood Hazard Mitigation Advisory Committee will meet on July 20 to review those comments. Following that meeting, a final *Plan* document will be prepared which will include deadlines for the priority action items.

**Adoption:** [Option 1: The final *Plan* will be sent to each agency with a request for concurrence signature by the agency head. Concurrence shall be in the form of signing a memo to the Director of the Department of Natural Resources that states the agency agrees to participate on the Flood Mitigation Coordinating Committee and to assist in implementing the agency's share of the Action Plan. The memo may include clarifications of what the agency expects to do with its action items. This memo shall be considered a memorandum of agreement between the agency and DNR.

[Option 1 continued: Once the memos have been signed by at least five of the six lead agencies, this *Plan* shall be considered adopted. The Director of DNR shall direct the Department's Flood Mitigation Office to schedule meetings of the Coordinating Committee and proceed with implementing the action items.]

**Adoption:** [Option 2: The final *Plan* will be sent to each agency with a request for concurrence signature by the agency head. Concurrence shall be in the form of signing a memo to the Governor that states the agency agrees to participate on the Flood Mitigation Coordinating Committee and to assist in implementing the agency's share of the Action Plan. The memo may include recommendations for revisions to the action items.

[Option 1 continued: The Governor will issue an executive order adopting the *Flood Hazard Mitigation Plan*, creating the Flood Mitigation Coordinating Committee and setting the deadlines for reports and key action items.]

***Progress Reporting:*** The Flood Mitigation Coordinating Committee will meet at least quarterly to review progress toward implementing the action items. On the anniversary date of adoption of this *Plan*, the Committee will prepare an annual progress report. The report will include:

- ! A review of the original plan.
- ! A review of any floods that occurred during the previous year.
- ! A summary of important mitigation activities accomplished by participating agencies or communities.
- ! A review of the action items, including how much was accomplished during the previous year.
- ! A discussion of why any action items were not completed or why implementation is behind schedule.
- ! New and/or revised action items.

The progress report will be distributed to the Governor, key members of the General Assembly, participating agencies and organizations, and the media.

By the anniversary date in the year 2004, the Coordinating Committee will prepare a final progress report. It will include recommendations for a complete review and revision, as necessary, of this *Plan*. The report may recommend that the Flood Mitigation Coordinating Committee continue, disband, “sunset” or be incorporated into another state-wide mitigation organization.



## *A. Communities in the National Flood Insurance Program*

ABBEVILLE  
HONEA PATH  
WARE SHOALS

ABBEVILLE COUNTY  
ABBEVILLE COUNTY  
ABBEVILLE COUNTY

AIKEN  
BURNETTOWN  
JACKSON  
NEW ELLENTON  
NORTH AUGUSTA  
Unincorporated areas

AIKEN COUNTY  
AIKEN COUNTY  
AIKEN COUNTY  
AIKEN COUNTY  
AIKEN COUNTY  
AIKEN COUNTY

FAIRFAX  
ULMER  
Unincorporated areas

ALLENDALE COUNTY  
ALLENDALE COUNTY  
ALLENDALE COUNTY

ANDERSON  
BELTON  
CLEMSON  
IVA  
PENDLETON  
WILLIAMSTON  
Unincorporated areas

ANDERSON COUNTY  
ANDERSON COUNTY  
ANDERSON COUNTY  
ANDERSON COUNTY  
ANDERSON COUNTY  
ANDERSON COUNTY  
ANDERSON COUNTY

BAMBERG  
DENMARK  
Unincorporated areas

BAMBER COUNTY  
BAMBERG COUNTY  
BAMBERG COUNTY

BARNWELL  
BLACKVILLE

BARNWELL COUNTY  
BARNWELL COUNTY

BEAUFORT  
BLUFFTON  
HILTON HEAD ISLAND  
PORT ROYAL  
YEMASSEE  
Unincorporated areas

BEAUFORT COUNTY  
BEAUFORT COUNTY  
BEAUFORT COUNTY  
BEAUFORT COUNTY  
BEAUFORT COUNTY  
BEAUFORT COUNTY

GOOSE CREEK  
HANAHAN  
MONCK'S CORNER  
Unincorporated areas

BERKELEY COUNTY  
BERKELEY COUNTY  
BERKELEY COUNTY  
BERKELEY COUNTY

CAMERON

CALHOUN COUNTY

AWENDAW  
CHARLESTON  
FOLLY BEACH  
HOLLYWOOD  
ISLE OF PALMS  
JAMES ISLAND  
KIAWAH ISLAND  
MCCLELLANVILLE  
MEGETT  
MOUNT PLEASANT  
NORTH CHARLESTON  
RAVENEL  
ROCKVILLE  
SEABROOK ISLAND  
SULLIVAN'S ISLAND  
Unincorporated areas

CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY  
CHARLESTON COUNTY

GAFFNEY  
Unincorporated areas

CHEROKEE COUNTY  
CHEROKEE COUNTY

CHESTER  
GREAT FALLS  
Unincorporated areas

CHESTER COUNTY  
CHESTER COUNTY  
CHESTER COUNTY

CHERAW  
Unincorporated areas

CHESTERFIELD COUNTY  
CHESTERFIELD COUNTY

MANNING  
SUMMERTON  
Unincorporated areas

CLARENDON COUNTY  
CLAREENON COUNTY  
CLARENDON COUNTY

EDISTO BEACH  
WALTERBORO  
Unincorporated areas

COLLETON COUNTY  
COLLETON COUNTY  
COLLETON COUNTY

DARLINGTON  
HARTSVILLE  
LAMAR  
Unincorporated areas

DARLINGTON COUNTY  
DARLINGTON COUNTY  
DARLINGTON COUNTY  
DARLINGTON COUNTY

DILLON  
LAKE VIEW  
LATTA

DILLION COUNTY  
DILLION COUNTY  
DILLION COUNTY

HARLEYVILLE  
SUMMERVILLE  
Unincorporated areas

DORCHESTER COUNTY  
DORCHESTER COUNTY  
DORCHESTER COUNTY

EDGEFIELD  
Unincorporated areas

EDGEFIELD COUNTY  
EDGEFIELD COUNTY

Unincorporated areas

FAIRFIELD COUNTY

FLORENCE  
JOHNSONVILLE  
LAKE CITY  
PAMPLICO  
QUINBY  
SCRANTON  
Unincorporated areas

FLORENCE COUNTY  
FLORENCE COUNTY  
FLORENCE COUNTY  
FLORENCE COUNTY  
FLORENCE COUNTY  
FLORENCE COUNTY  
FLORENCE COUNTY

GEORGETOWN  
PAWLEYS ISLAND  
ANDREWS  
Unincorporated areas

GEORGETOWN COUNTY  
GEORGETOWN COUNTY  
GOERGETOWN COUNTY  
GEORGETOWN COUNTY

FOUNTAIN INN  
GREENVILLE  
GREER  
MAULDIN  
SIMPSONVILLE  
TRAVELERS REST  
Unincorporated areas

GREENVILLE COUNTY  
GREENVILLE COUNTY  
GREENVILLE COUNTY  
GREENVILLE COUNTY  
GREENVILLE COUNTY  
GREENVILLE COUNTY  
GREENVILLE COUNTY

GREENWOOD  
NINETY SIX  
Unincorporated areas

GREENWOOD COUNTY  
GREENWOOD COUNTY  
GREENWOOD COUNTY

BRUNSON  
ESTILL  
FURMAN  
HAMPTON  
SCOTIA  
VARNVILLE  
Unincorporated areas

HAMPTON COUNTY  
HAMPTON COUNTY  
HAMPTON COUNTY  
HAMPTON COUNTY  
HAMPTON COUNTY  
HAMPTON COUNTY  
HAMPTON COUNTY

ATLANTIC BEACH  
AYNOR  
BRIARCLIFFE ACRES  
CONWAY  
LORIS  
MYRTLE BEACH  
NORTH MYRTLE BEACH  
SURFSIDE BEACH  
Unincorporated areas

HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY  
HORRY COUNTY

HARDEEVILLE  
RIDGELAND  
Unincorporated areas

JASPER COUNTY  
JASPER COUNTY  
JASPER COUNTY

CAMDEN  
Unincorporated areas

KERSHAW COUNTY  
KERSHAW COUNTY

KERSHAW  
LANCASTER  
Unincorporated areas

LANCASTER COUNTY  
LANCASTER COUNTY  
LANCASTER COUNTY

CLINTON  
LAURENS  
Unincorporated areas

LAURENS COUNTY  
LAURENS COUNTY  
LAURENS COUNTY

BISHOPVILLE  
LYNCHBURG  
Unincorporated areas

LEE COUNTY  
LEE COUNTY  
LEE COUNTY

BATESBURG-LEESVILLE  
CAYCE  
GILBERT  
IRMO  
LEXINGTON  
PELION  
PINE RIDGE  
SOUTH CONGAREE  
SPRINGDALE  
SWANSEA  
WEST COLUMBIA  
Unincorporated areas

LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY  
LEXINGTON COUNTY

MARION  
MULLINS  
SELLERS  
Unincorporated areas

MARION COUNTY  
MARION COUNTY  
MARION COUNTY  
MARION COUNTY

BENNETTSVILLE  
Unincorporated areas

MARLBORO COUNTY  
MARLBORO COUNTY

MCCORMICK  
Unincorporated areas

MCCORMICK COUNTY  
MCCORMICK COUNTY

NEWBERRY  
WHITMIRE  
Unincorporated areas

NEWBERRY COUNTY  
NEWBERRY COUNTY  
NEWBERRY COUNTY

SENECA

OCONEE COUNTY

WALHALLA  
WESTMINSTER  
Unincorporated areas

OCONEE COUNTY  
OCONEE COUNTY  
OCONEE COUNTY

HOLLY HILL  
NORWAY  
ORANGEBURG  
Unincorporated areas

ORANGEBURG COUNTY  
ORANGEBURG COUNTY  
ORANGEBURG COUNTY  
ORANGEBURG COUNTY

EASLEY  
LIBERTY  
PICKENS  
Unincorporated areas

PICKENS COUNTY  
PICKENS COUNTY  
PICKENS COUNTY  
PICKENS COUNTY

ARCADIA LAKES  
COLUMBIA  
EASTOVER  
FOREST ACRES  
Unincorporated areas

RICHLAND COUNTY  
RICHLAND COUNTY  
RICHLAND COUNTY  
RICHLAND COUNTY  
RICHLAND COUNTY

SALUDA

SALUDA COUNTY

CAMPOBELLO  
DUNCAN  
INMAN  
LANDRUM  
LYMAN  
PACOLET MILLS  
SPARTANBURG  
WOODRUFF  
Unincorporated areas

SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY  
SPARTANBURG COUNTY

SUMTER  
Unincorporated areas

SUMTER COUNTY  
SUMTER COUNTY

LOCKHART  
UNION

UNION COUNTY  
UNION COUNTY

GREELEYVILLE  
HEMINGWAY  
KINGSTREE  
LANE  
STUCKEY  
Unincorporated areas

WILLIAMSBURG COUNTY  
WILLIAMSBURG COUNTY  
WILLIAMSBURG COUNTY  
WILLIAMSBURG COUNTY  
WILLIAMSBURG COUNTY  
WILLIAMSBURG COUNTY

CLOVER  
FORT MILL

YORK COUNTY  
YORK COUNTY

ROCK HILL  
YORK  
Unincorporated areas

YORK COUNTY  
YORK COUNTY  
YORK COUNTY

## *B. Community Rating System*

### **Background**

The Community Rating System (CRS) provides a flood insurance premium rate reduction for communities that implement activities above and beyond the minimum requirements of the National Flood Insurance Program. The CRS provides credits for a variety of community flood protection activities, organized under four general series:

- 300 Public information
- 400 Mapping and regulatory activities
- 500 Flood damage reduction
- 600 Flood preparedness

To receive a 5% or 10% CRS flood insurance premium reduction, a community applies to the Federal Emergency Management Agency. This involves application worksheets and presentation of appropriate documentation. FEMA sends a CRS Specialist from the Insurance Services Office, Inc. (ISO). The ISO/CRS Specialist visits the community and verifies that the activities are being implemented as described in the application.

The community is given points based on the ISO/CRS Specialist's evaluation and verification of the activities. In some cases, additional points are provided for activities that are implemented on a regional or state level. The ISO/CRS Specialist is kept abreast of any changes in the Community's program and conducts periodic visits to verify continued implementation.

### **Benefits**

If the community does not have many flood insurance policies in effect, there would be a relatively low direct financial benefit from participating in the CRS. However, more residents should have flood insurance, especially if the community implements the recommended public information programs. The more policies sold, the more people would benefit from the community's flood program, even when it doesn't flood.

More importantly, there are some nonfinancial benefits to the CRS:

- ! The CRS flood hazard mitigation activities provide enhanced public safety, a reduction in damage to property and public infrastructure, avoidance of disruption and losses, reduction of human suffering, and protection of the environment.

- ! A community can evaluate the effectiveness of its flood program against a nationally recognized benchmark. Currently, 27 South Carolina communities participate. There are approximately 900 communities participating nationally.
- ! Technical assistance in designing and implementing some activities is available at no charge from ISO.
- ! A CRS community's flood program benefits from having an added incentive to maintain its flood programs over the years. The fact that the community's CRS status could be affected by the elimination of a flood-related activity or a weakening of the regulatory requirements for new development, should be taken into account by the governing board when considering such actions. A similar system used in fire insurance rating has had a strong impact on the level of support local governments give to their fire protection programs.
- ! Implementing some CRS activities, such as flood hazard mitigation planning, can help a community qualify for certain federal assistance programs.

In other words, the CRS encourages communities to keep their flood programs going during times of drought and lack of interest. This would be the greatest benefit to the floodprone residents of a floodprone community.

## **Activities**

There are 18 activities organized under 4 series. The following list summarizes the activities and the average number of points that communities have received for them. Each 500 points brings a better CRS class and an additional 5% premium rate reduction.

### *Public Information Activities (Series 300)*

310 (Elevation Certificates) Maintain FEMA elevation certificates for all new construction after the date of CRS application. This is a minimum requirement for any CRS credit. (72)

320 (Map Information) Respond to inquiries to identify a property's FIRM zone and publicize this service. (138)

330 (Outreach Projects) Send information about the flood hazard, flood insurance, and flood protection measures to floodprone residents or all residents of the community. (81)

340 (Hazard Disclosure) Real estate agents advise potential purchasers of floodprone property about the flood hazard; or regulations require a notice of the flood hazard. (24)

350 (Flood Protection Library) The public library maintains references on flood insurance and flood protection. (22)

360 (Flood Protection Assistance) Give inquiring property owners technical advice on how to protect their buildings from flooding and publicize this service. (57)

#### *Mapping and Regulatory Activities (Series 400)*

410 (Additional Flood Data) Develop new flood elevations, floodway delineations, wave heights, or other regulatory flood hazard data for an area that was not mapped in detail by the flood insurance study; or have the flood insurance study's hydrology or allowable floodway surcharge based on a higher state or local standard. (148)

420 (Open Space Preservation) Guarantee that a portion of currently vacant floodplain will be kept free from development. (206)

430 (Higher Regulatory Standards) Require freeboard; require soil tests or engineered foundations; require compensatory storage; zone the floodplain for minimum lot sizes of 1 acre or larger; regulate to protect sand dunes; or have regulations tailored to protect critical facilities or areas subject to special flood hazards (e.g., alluvial fans, ice jams, or subsidence). (159)

440 (Flood Data Maintenance) Keep flood and property data on computer records; use better base maps; or maintain elevation reference marks. (78)

450 (Stormwater Management) Regulate new development throughout the watershed to ensure that post-development runoff is no worse than pre-development runoff. (122)

#### *Flood Damage Reduction Activities (Series 500)*

510 (Floodplain Management Planning) Prepare, adopt, implement, and update a comprehensive flood hazard mitigation plan using a standard planning process. (34)

520 (Acquisition and Relocation) Acquire and/or relocate floodprone buildings so that they are out of the floodplain. (177)

530 (Retrofitting) Document floodproofed or elevated pre-FIRM buildings. (66)

540 (Drainage System Maintenance) Conduct periodic inspections of all channels and retention basins and remove debris as needed. (236)

*Flood Preparedness Activities (Series 600)*

610 (Flood Warning Program) Provide early flood warnings to the public and have a detailed flood response plan keyed to flood crest predictions. (99)

620 (Levee Safety) Maintain levees that are not credited with providing base flood protection. (153)

630 (Dam Safety) All communities in a state with an approved dam safety program receive credit. (57 points in South Carolina)